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PSYCHOLOGIC IMPLICATIONS OF PHYSICAL THERAPY

JAMES L. HALLIDAY, M.D.

GLASGOW, SCOTLAND

In a previous paper¹ it was noted that in a considerable number of patients their conditions labeled by vague terms indicative of non-arthritic rheumatism (as well as by more specific terms such as fibrositis), are best interpreted as psychoneurotic or psychosomatic disorders. It was also pointed out how the nature and etiology of such "rheumatism" cannot be appreciated by the physician unless he supplements his routine, physical examination by a simple psychologic approach, because in its absence the range of relevant observations may be too narrow, and as a result, faulty inferences may be made. The present paper discusses a corollary of these conclusions, viz.: If no cognizance is taken of the important role played by psychologic factors in onset and recovery, it is impossible accurately to assess the effect of any one method of physical therapy.

This form of treatment may have potent psychologic implications to the patient who makes contact with and reacts to physical therapy, not only with his "soma," but also with his "psyche." If this is recognized, we need no longer remain perplexed at the varying results obtained by any therapeutic method in any "type" case—sometimes dramatically successful, sometimes of no avail, and sometimes, if we have the ability to see what we do not want to see, prolonging and fixing symptoms.

Psychologic Factors

The foregoing considerations in no way imply that physical therapy should be denied to patients who may be categorized under the term "psychoneurotic rheumatism." They do, however, indicate that every therapist should be familiar with the possible psychologic implications of various forms of physical treatment. Indeed, such knowledge is of practical and everyday importance. The nature of their psychologic potency is indicated in the following factors.

1. *Removal from Home Surroundings to Hospital, Institutions or Spa.* — This eases the patient from the immediate pressure of a noxious environment, whether domestic, occupational or financial. What is out of sight tends, at least temporarily, to be out of mind. The rheumatism may improve or even disappear because the patient is no longer enmeshed in the problems, a solution of which he has tried to avoid by means of his illness. Other points which might come under this section — but which need not be elaborated here — are:

(a) To be in bed and be nursed is to become a baby again — others take over the responsibilities.

(b) The collective spirit of an institution or spa may break down the patient's sense of isolation and lead him to feel that he is not alone in his suffering.

(c) The social distractions of a spa may stimulate the patient's interest externally, thus turning it away from his bodily complaints toward the new surroundings which he meets.*

* Note: These phenomena of temporary improvement with removal to an institution are well exemplified in psychosomatic asthma. It has been computed that 70 per cent of asthmatics admitted to hospital, cease to have attacks during their period of residence, irrespective of treatment received. Indeed, there is a plaintive note in one of the Annual Reports of the British "Asthma Research Council" to the effect that investigations into asthmatic attacks at certain hospitals could not be carried out because the patients, after admission, refused to develop further seizures!

2. *Massage.*—The application of the mild form is a classical method of inducing a hypnotic state, during which verbal suggestions as to cure may prove beneficial. When little children fall and cry out for their mother she lifts them on her knee and says — "Mummy stroke it and make it better." With the stroking the cries subside. A wiser mother, however, will say — "Look! What is that out of the window?" and direct the child's interest away from his body because she has learned that repeated stroking and rubbing tend to provoke in the child a habit of always howling at the slightest inconvenience, whereas distraction of attention does not do so.

Many observers hold the opinion that deep massage to be effective in removing fibrositic thickening, must be sufficiently strenuous to cause the patient discomfort. This opinion requires to be collated with the knowledge that the induction of localized pain — whether by pressure, slapping, the application of a red-hot poker, or by injection of substances such as ether, alcohol, or turpentine — is a crude method of treating hysteria. By such therapy the interest of the patient is definitely diverted from its deep lurking place in "the self" and directed to an object which is more externalized. For example, by the injection of ether, a hysterically fixed joint may become free or a functional spasm of the gullet relaxed so that a "bougie" or stomach tube may be passed. The use of similar methods is known to primitive races. A medical officer in the West African Service tells me that when a black man has Ju-Ju put on him by the witch-doctor he loses all interest, sinks into himself, refuses food, lies down and dies. It appears, however, that the fatal effects of the spell may sometimes be avoided by employing strong external irritation. A physician may attain this by injecting turpentine, whereas a native medicine man may employ burning peppery fumes which scorch the skin. Each of these methods has this in common, that it provokes the interest of the patient toward his surface and his surroundings. It is the custom in some country districts in Scotland when a person becomes unconscious through "a shock," to keep slapping the face smartly in the hope of keeping the interest of the patient directed toward the environment and thus preventing it from slipping past the bourne from which it cannot return. The rationale of deep massage which must be painful, may not always be what it seems!

3. *Injections.*—Injections, whether into the skin, the rectum or the esophagus, represent penetration of the organism and may thus have a deepseated significance which is probably sexual. Certain patients on receiving an injection of antitoxin into the thigh react with behavior which can properly be characterized as "orgasmic." They are usually young women, especially those of the plump and giggly type. In asthma it is known that injections of normal saline may sometimes abort an attack. "To be injected" may alleviate the symptoms of many disorders, at least for a short time. Similar considerations apply to "injections" which wash out the bowel or the stomach.

4. *Internal Cleansing.*—Many of the patients who develop a habit of bowel or stomach lavage have a deepseated sense of guilt associated with repressed aggressive tendencies, and these procedures serve to make them feel that they are, temporarily at least, cleansed and free of iniquity. Vegetable diet may also bring about a similar feeling of inward cleanliness, the person receiving assurance that he is pure within when he notices that "his feces cease to smell and the perspiration from his armpits loses its odor." Advertisements for patent medicines for the cure of rheumatism may by the nature of their wording play upon the patient's underlying sense of guilt. They emphasize impurity—whether of the blood, stomach or intestine —

and they suggest that a particular preparation, by its power of internal washing and cleansing, will rid the patient of his impurities and bring him salvation.

5. *Operations.* — Operations may represent punishment — deserved and desired — in persons with a deep sense of guilt. This may sound fantastic, but something analogous is seen in ordinary parental observation. Any alert parent has observed how a young child who is reasonably good, tends to enter upon a phase of repeated deeds of naughtiness. The child, as we say, is "working up for a whipping," or is "asking for it." When at last the parent loses his temper and applies the natural physical corrective — "warming their young botts" as the author of *Rab and His Friends* puts it — the child becomes himself again for a longer or shorter period, until the next crisis occurs. Psychologists tell us that this punishment is actually courted by the child and is a method of atoning for an accumulation of guilt. It is a matter of everyday medical observation that certain patients are very desirous of having an operation and will visit doctor after doctor until they find one who gives his consent. The operations usually demanded are on the nose, the uterus and abdomen. After such punitive operations the patient, like the child after his masochistic whipping, recovers for a varying period. Unfortunately the appetite grows with what it feeds on and further operations are sought and, if obtained, may become disastrous.

Electro-Hydrotherapy

The idea of electricity has a significance which is magical. It is a common constituent of delusions. A psychotic patient will relate that he is being subjected to attacks of electricity; or that electricity has got into his food; or that by means of wireless, rays or radium his thoughts are being read or the interior of his body is rendered visible. These considerations may have some connection with the popularity, and perhaps even with the transient success of those electrical appliances, more or less physically impotent, which year by year flit across the therapeutic stage. They act like magic because they are magic.*

Water cures are manifold in their meaning, but from the standpoint of psychologic medicine two great groups may be discerned, namely, the Earth Water which represents a return to the Mother as a prelude to rebirth, and the Heavenly Water which represents a contacting with the "Spirit" (of the Fathers).

Earth Water is represented not only by baths of mud or of peat, which are brown, marshy and fecal, but also by warm water. There is no doubting the very evident soothing and relaxing effect of warm sprays and baths. Under their influence movements previously impossible may be actively or passively made and pain may be alleviated. From the phylogenetic standpoint it is legitimate to compare warmth, wetness, and also darkness, with the intra-uterine environment which, according to certain psychologists, is associated with feeling of peace and omnipotence. This environment is artificially, although unwittingly, reproduced by physical-theraputists; par-

* Note: To readers versed in advanced medical psychology I should like to state that I am aware of the dubiety of linking the therapeutic effect of electricity with symptoms of schizophrenia. A schizophrenic patient has thoughts and hears voices which he believes to be other than his own. In modern times a common rationalization of such apparent sensory perceptions is that they are due to electricity or invisible rays. This, however, is not a primary experience but is a secondary rationalization. In olden times the blame was put upon devils and spirits. Actually rationalizations about electricity are not taken too seriously by these patients who may change their theories from time to time about the nature of the external influence which they believe they are experiencing. The real magical effect of electricity is to be found in its symbolic meaning as the spiritual male power, like the lightning which kills and comes down from heaven. It is also comparable to the storm and wind which are invisible and which can overwhelm and destroy us.

tially, by warm baths, and almost completely by steam cabinets or full immersion mud-baths, which provide darkness as well as warmth and wet.*

Heavenly Water is represented by water in agitation, whether by spray, douche or aeration. In these forms it corresponds to "living water," i.e., water flowing and moving which represents eternal life. When an individual is in contact with water he appears to be peculiarly liable to respond to psychologic factors which suggest cure, regeneration or re-birth. This has been sensed throughout the ages and has been utilized by various religions in the initiation ceremony of baptism, whether by sprinkling, dipping or immersion. The ritual was practiced before the time of Christ in the mysteries of Eleusis and in the cults of Mithras and Isis. The person to be baptized prepared himself for several days with prayer and fasting, and before the ceremony he was addressed concerning matters pertaining to the "the two ways" — the way of life and the way of death. The spirit, or *pneuma* — not the water or *hydor* — is the essential element. The water, however, renders the person more liable to receive the *pneuma* and be affected by it. Undue emphasis always tends to be placed on the physical aspects of a ritual and its elaborations. The water is extolled and the spirit forgotten. This is clearly expressed by Justin Martyr:

The cisterns which you have dug for yourselves are broken and profitless to you. For what is the use of the baptism which cleanses the flesh and body alone? Baptize the soul from anger, from envy, and from hatred, and lo — the body is pure.

These words written about 150 A. D. refer to matters other than medical. However, they happen to epitomize rather neatly much that we have been discussing about the etiology and treatment of "rheumatism" when this is studied by the psychologic approach. The quotation raises numerous questions many of which but not all, are outside the scope of this paper. For example, how far does the success of immersion therapy depend not so much on the water or *hydor*, as on the atmosphere or *pneuma*, engendered by the kindness, understanding and hopefulness of the doctor and his attendants? In short, how far is success related to the personality and beliefs of the therapist? Could better results be obtained by immersion therapy if this was preceded by psychologic investigation and psychotherapy whereby the patient would discover for himself that such emotions as resentment, pride and hate are related to his illness and are indeed "the way of death" (*thanatos*); whereas acceptance, forgiveness and renewal of personal responsibility are indeed "the way of life" (*eros*)? These questions are not mystical ones, and under controlled experiment could be provided with answers in numerical form. Baths and establishments may be bigger and better yet — the water without the spirit may be profitless.

Practical Application

Members of the medical profession are apt to dismiss with scorn accounts of "cures" by unorthodox methods whether at sacred shrine, mediumistic séances, mission halls "filled with mass emotion," or at the hands of faith healers and pathies of all descriptions. We tend to say either that such cures do not take place — which is simply not true — or else that the patients who benefit must be examples of hysteria or neurosis — which may be partially true. On the other hand we should resent very much the suggestion that any success we may obtain by various methods of physical therapy depended on the psychologic as much as on the physical effects and that many of our most brilliant "cures" were in patients whose illness was predominantly

* Note: Next time the reader has a hot bath at night, he should put out all the lights and with a towel under his head lie relaxed amid the water and darkness. As the minutes pass he will find if he does not immediately fall asleep, that it is a strange, even eerie experience.

psychosomatic in nature and origin. Yet this may quite well be true, but we shall not be able to state how far it applies until we add to our examination a technic which will help us to determine more comprehensively "what is really wrong with the patient." Words such as fibrositis or myositis tell us something of a localized derangement of bodily mechanism, but in no way inform us about their etiology. As a prelude to assessing the value of any method of physical therapy it is necessary first, to determine how far the patient may be regarded as an example of psycho-neuro-endocrine disorder, and second, to relate our findings to the psychologic implications of the method of treatment adopted. To illustrate the practical issues, the following piece of research may be quoted.

A carefully written article was published by Kellgren² in which he described in detail eight patients with "fibrositis or myalgia" whom he had treated by injections of novocain into the "nodal points of tenderness" to which the diffuse muscle pain was referred. The results were beneficial and "in instances in which novocain infiltration aborted the symptoms, the effect often outlasted the actual anaesthesia and was more or less permanent. Unfortunately no conclusions can be drawn from this piece of work for two reasons.

First, although five of the eight patients had complained of pain for six months or over, no psychologic investigation appears to have been made, e.g., there is no hint about the patient's facial appearance and manner, and all that is mentioned is that they were in good or in fair general health. No inquiries were directed to find out if the patients had suffered from emotional reaction following loss, frustration or disappointment. Although "fibrositis" was apparently present we really are left in ignorance as to what was wrong with the sufferers. All we know is that they had tender nodules with areas of referred pain which followed a spinal segmental pattern.

Second, no account was taken of the possible psychologic effects of the injection — apart from novocain — and it is noteworthy that, in the correspondence which followed, Mennell recalled how Kellgren's procedure was in the old tradition of needling. At first red-hot needles were used. Later, successes were found to follow by needling without heat. Then needling fell out of fashion but was renewed by the introduction of the galvanic needle. The latest development was that the needle should inject novocain. Mennell adds "When injection has failed, injection followed by a very free needling throughout the injected area will bring relief, and particularly if the area is subjected to a process (not too vigorous) hammering of the area by blows from a mallet transmitted through a rod of wood protected by a felt pad." This is most interesting! Penetration of the organism as well as hurting the patient — in Mennell's procedure, "giving him a good hammering" — are age-old procedures associated with the treatment of hysteria, devil possession, melancholia and other neurotic and psychotic ailments!

A problem of the future will be to learn how to combine physical therapy and psychotherapy. This investigation will require research in which the medical physicist and the medical psychologist must work in cooperation.

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EFFECT OF SHORT WAVE DIATHERMY ON ARTERIAL PRESSURES

AN EXPERIMENTAL STUDY *

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ROCHESTER, MINNESOTA

Considering the great mass of reported investigations dealing with the physiologic effects of short wave diathermy, relatively little has been written on the effects of these currents on the blood pressures either in man or in experimental animals. This paucity of literature on the subject would seem to indicate that short wave diathermy has little significant effect on the blood pressure. However, certain investigators have presented clinical and experimental work which might indicate that there is a specific effect of this procedure. The results of these investigators have been contradictory. Some reported that these currents brought about a lowering of the blood pressures, while others found a heightening effect.

Certain physiologic phenomena must be recognized before a proper evaluation of these investigations can be made. In the light of our present knowledge, the undisputed effects of short wave diathermy can all be explained on the basis of the heat produced in the tissues. This does not in any way detract from the value of short wave diathermy, but rather tends to place its application on a physiologic basis. It has been shown repeatedly that the blood pressures in man and in animals can be altered by the application of heat to the body. Bazett¹ found that the diastolic pressure consistently decreased when the human body was immersed in a warm water bath. At mild water temperatures (95 to 98 F. [35.0 to 36.7 C.]) the systolic pressure usually was lowered, but increased somewhat at higher temperatures. Sayers and Harrington² found a decrease of both systolic and diastolic pressures in normal healthy adults enclosed in a room saturated at 100 F. (37.8 C.). At environmental temperatures above this, ranging between 39 and 46 C., Adolph and Fulton³ observed an increase in the systolic and a decrease in the diastolic pressure.

The reactions of the blood pressures during artificially produced hyperpyrexia in man (as in fever therapy) seem to follow this general trend. No gross difference has been reported to exist between pressures obtained during fever produced by means of high environmental temperature, and those during fever brought about by short wave diathermy. Ewalt and his associates⁴ made an inclusive statement covering the variations in pressure during all methods of physically induced hyperpyrexia. They pointed out that the diastolic pressure quickly decreases to extremely low levels while the

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⁴ Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 5, 1940.

systolic usually increases moderately early in the induction period, and then assumes a level somewhat below normal. Krusen and one of us (Elkins⁵) have found this to be true when using the Kettering hypertherm, which is simply a cabinet heated by warmed, moist air. Neymann,⁶ and Bierman and Fishberg⁷ reported this same general trend when fever is induced by short wave diathermy cabinets.

Some difference exists in the reported pressure variations of animals during hyperpyrexia by the two different methods. Hartman and Major,⁸ using a Kettering hypertherm to create fever in dogs, found usually a marked drop in both systolic and diastolic pressures (in one case as low as 30 mm. of mercury systolic and 0 diastolic). Cheer,⁹ also using a heated cabinet on dogs, found a marked decrease in both pressures. Guizetti,¹⁰ with short wave diathermy on dogs, found an initial drop followed by a slow return to normal in sixteen to twenty minutes. The elevation in bodily temperature was only about 1.0 C. in his cases. Karapetjan and Frenckell,¹¹ also using short wave diathermy on dogs, found that the systolic pressure decreased and the diastolic increased somewhat. Wiggers and Orias,¹² employing short wave diathermy on dogs, found a marked elevation of both systolic and diastolic pressures after the bodily temperatures reached approximately 40 to 41 C.

These findings of Wiggers and Orias are extremely interesting because they can be contrasted directly with the work of Cheer, which was also done in Wiggers' laboratory. Both these investigators used similar manometric methods of determining direct intra-arterial pressures. Cheer utilized a simple chamber heated by infra-red luminous bulbs, enclosing the dog's body with head protruding through an opening at one end, and found that the pressures, both systolic and diastolic, decreased markedly when the dog's rectal temperature rose to 40 to 41 C. Wiggers and Orias, on the other hand, with a similar but unheated cabinet, induced hyperpyrexia by short wave diathermy plates suspended next to the dog's body, and found a great increase in both systolic and diastolic pressures after the animal's rectal temperature rose to 40 to 41 C. If the height of fever was increased, the pressures sharply decreased when circulatory failure from asphyxia (primary respiratory failure) took place.

The investigations of Weisz, Pick and Tomberg¹³ have proved quite conclusively that the vascular response to heat is similar whether the tissues are heated by diathermy or warm Ringer's solution, and that these responses take place at identical tissue temperatures. Heinle and Phelps¹⁴ found that short wave irradiation of an isolated perfused cat heart in no way influenced the natural tendency toward an increasing hypodynamic state. They further found no evidence that the elasticity of the aortic rings is affected either directly or indirectly by the short wave diathermy.¹⁵ Dicker¹⁶ observed no change in the arterial pressure in the kidney during irradiation with short wave diathermy.

Trolow and his associates¹⁷ described a lowering of both systolic and diastolic pressures in patients with essential hypertension by short wave diathermy irradiation through the celiac plexus. Vannotti¹⁸ produced hypotension by irradiation of the region of the carotid sinus. There is no reason to conclude from these investigations that this is a specific action of short wave diathermy apart from that of deep tissue heating, which might cause temporary vasodilatation. Apel¹⁹ stated that short wave diathermy applied thrice weekly caused a lowering of the systolic blood pressure in man from 180 to 150 mm. of mercury. The basis for the hypertension was not adequately explained, nor was it brought out that the patient might

have simply been on a routine of restricted activity during the period of months over which the diathermy was applied. Likewise, Rausch²⁰ reported five cases of "renal hypertension" in which daily short wave diathermy applied over a short period caused a fall of 25 to 43 m. of mercury in the systolic pressure.

The work of Wiggers and Orias¹² requires thoughtful consideration since it was done very carefully and thoroughly by a man with particular knowledge of pressure pulses and the apparatus used in the determination of direct intra-arterial pressures. So far as we know, it is the only investigation of its kind reported in which hyperpyrexia was produced in animals by the application of short wave diathermy and direct intra-arterial pressures were recorded.

The reaction of the heart rate to an increase in bodily temperature is fairly constant and undisputed. Knowlton and Starling²¹ found that the rate of the isolated dog's heart is determined entirely by its temperature, the pressures being kept constant. They noted a change in rate from 138 beats per minute at 36.0 C. to 165 beats per minute at 41.0 C. (approximately 5 beats per degree centigrade increase). Bazett¹ stated that the increase in pulse rate in man is of a similar order (8 to 10 beats per degree rise above 98.6 F.), whether the temperature is raised by a hot bath, by sitting in a hot room or by organic infection. Adolph and Fulton³ found that the pulse tripled its rate when the bodily temperature was raised from 37 to 40 C. In a series of 500 cases, Bierman and Fishberg⁷ determined that the pulse in man increased an average of 8.5 beats per minute per degree Fahrenheit rise in rectal temperature. Uyeno²² found an increase of 53 per cent (from 165 to 252 beats per minute) in an animal whose rectal temperature had been raised 5 C. by a warm bath. Both Wiggers and Cheer noted a consistent rise in pulse rate in their experiments with hyperpyrexia in animals.

From the preceding brief review of the literature it seemed evident that no two adequately performed investigations agreed on the effect of short wave diathermy on the blood pressure of the dog. The investigation of Wiggers and Orias deserves the utmost consideration. It is important because, if conclusive, it might mean that short wave diathermy has a "specific" effect apart from that of induced heat which might constitute a possible hazard in the treatment of hypertensive human patients. It was with this thought in mind that the following investigation was carried out.

Method

When this work was first begun, it was thought that bodily temperature could be raised simply by applying several turns of the cable type of electrode under or around the animal's body. However, it was soon found that the efficiency of the dog's heat dissipating mechanism was such that it maintained a normal bodily temperature, measured rectally, even after one hour's irradiation by our short wave apparatus. We do not doubt that with moderately deep anesthesia the animal's bodily temperature could have been raised to any desired level. This factor will be discussed later. Large plate electrodes placed in various positions over and under the animal's body likewise failed to raise the general bodily temperature to any great extent. Our short wave generator was, in practically all experiments, tuned gradually to its maximal output.

Consequently, our next thought was to impede the dog's rate of heat dissipation through its respiratory system until the efficiency of our high frequency generation was such that it could introduce heat into the animal's

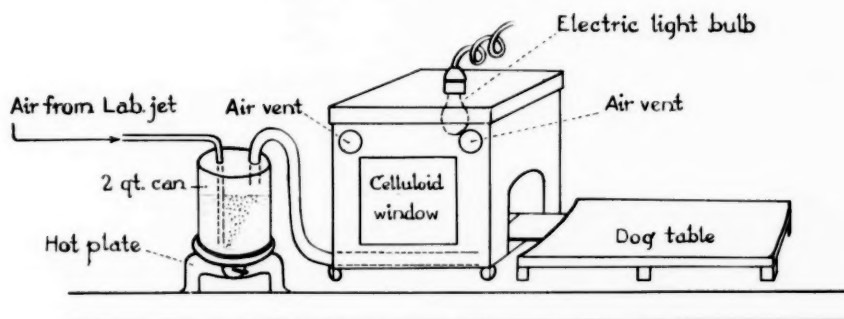


Fig. 1. — Head cabinet used to produce fever in animals.

body at a faster rate than it could be eliminated. This was done by placing the animal's head in a cabinet in which warm, highly humidified air was circulated (fig. 1). By this means the dog's rate of heat loss through its respiratory system was easily controlled. This cabinet was described in detail in a previous paper.²³

It was found that a cabinet temperature of 36 C. (96.8 F.), certainly well below the dog's bodily temperature, which averages 100.5 F. (38 C.) according to deBeer and Hjort,²⁴ combined with the irradiation through the large plate electrodes, was capable of raising the dog's rectal temperature to 107 F. (41.7 C.) or higher, in forty-five to ninety minutes. To control this experiment, the cabinet alone, kept at 36 C. (96.8 F.) was used, and it was found that the dog's temperature in each of these several experiments actually fell during the two hours' exposure. This was brought about to some extent by the immobilization of the animal and was probably augmented by the warm, moist air, causing the dog to pant and thus further decrease his general bodily temperature. No significant change in arterial pressures was noted. From these controlled experiments we can logically assume that the addition of the cabinet in itself adds no significant factors to alter or mask the effect of the high frequency currents on arterial pressures.

As a further control, a fever of 107 to 109 F. (41.7 to 42.8 C.) was induced by using the cabinet alone. In these experiments it was found necessary to maintain the cabinet at 113 F. (45 C.) or above, to induce hyperpyrexia. The results in these experiments were interesting and will be discussed in detail later.

Short wave diathermy was applied by means of two wire-mesh plates measuring 12 by 18 inches (30 by 46 cm.) These plates were covered with sponge rubber and spaced about 1 to 1½ inches (2.5 to 3.8 cm.) from the nearest surface of the animal's body. One was suspended above the dog's body and the other tied in place beneath the wooden animal board under the dog's body. They were thus parallel and opposite to each other and similarly spaced. For hyperpyrexia induced by the diathermy, the cabinet, kept at 36 C. (96.8 F.), was adapted over the dog's head, thus not interfering in any way with the short wave application. To raise the bodily temperature by cabinet alone, the latter was kept at 45 C. (113 F.).

The arterial pressures were obtained from the femoral artery (except in four control cases where the carotid artery was used) and recorded on a photokymograph by means of a Hamilton manometer.²⁵ By this method, accurate pressure tracings could be obtained from the arteries of trained, unanesthetized dogs. No further operation was needed than to insert the needle through the skin into the artery. This same artery could be used over again many times if care was taken to press it with the fingers at

the point of puncture for several minutes immediately after the needle had been removed.

All dogs were trained to lie quietly on their sides or backs. A well trained animal scarcely moved when the needle was inserted through the skin into the artery. Most of them objected when their heads were placed in the cabinet. They were required to lie quietly on the board for at least a half hour before the experiment was started.

TABLE 1.—*Changes in Pulse Rate Per Minute and Arterial Pressures in Millimeters of Mercury on Application of Short Wave Diathermy Alone.*

Experiment	Period of Rest—		Period of Total Irradiation			Change		Percentage		Maximum Change in Diastolic		
	Pulse	Pressure	Time, Minutes	Pulse	Pressure	In-crease	De-crease	Sys-tolic	Dias-tolic	Time, Minutes	Pressure	Per Cent
2	84	160/95	40	70	173/90	....	14	+8.1	—5.3	Control	160/95	0.0
3	80	193/115	15	90	205/125	10	....	+6.2	+8.7	On 15	150/80	—15.8
										On 15	205/125	+ 8.7
										Off 1	155/100	—13.0
5	78	190/122	45	69	180/112	....	9	—5.3	—8.2	Control	190/122	0.0
										Off 1½	156/77	—36.9
6	90	170/88	20	72	165/81	....	18	—2.9	—7.8	Off 1½	174/90	+ 2.3
										Off 1½	156/77	—12.5
7	90	190/95	60	126	180/97	36	....	—5.3	+2.1	On 20	197/110	+15.8
										Control	190/95	0.0
11	72	154/87	65	120	145/82	48	....	—5.8	—5.7	Control	154/87	0.0
										Off 1½	137/80	— 8.0
15	132	168/90	35	108	175/96	....	24	+4.0	+6.7	On 5	186/111	+23.3
										Off 4	161/81	—10.0
17	138	177/94	60	150	156/88	12	....	—11.9	—6.4	Off 7	206/112	+19.1
										Off 2	157/86	— 8.5
18	114	185/88	60	108	189/92	....	6	+2.2	+4.4	On 6	217/117	+32.9
										On 2	160/69	—21.5
31	62	180/91	30	70	179/96	8	....	—0.4	+5.5	On 10	197/104	+14.3
										Off 5	165/82	— 9.9
42	150	206/107	60	138	200/100	....	12	—2.9	—6.5	Off 15	206/108	+ 0.9
										On 50	189/92	—14.0
26	96	166/78	150	96	162/72	0	....	—2.4	—7.6	On 10	167/88	+12.7
										On 150	162/72	— 7.6
32	120	173/87	180	88	173/89	....	32	—0.0	+2.2	On 120	184/89	+ 2.2
										Control	173/87	0.0
4	.....	112	60	.....	120	.....	.....	.....	.....	On 25	124	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	+7.1	On 40	112	0.0

Results

The changes in pulse and femoral arterial pressures after irradiation of the dog with short wave diathermy alone are listed in table 1. As was stated in the discussion of the methods used, no appreciable change in rectal temperatures was apparent, during or following irradiation. In experiment 11 the animal's temperature rose from 101.0 to 104.0 F. (38.3 to 40 C.) after sixty-five minutes of irradiation.

No constant change was noted in the pulse rate during of following irradiation. In the animal already mentioned whose temperature rose to 104.0 F. (40 C.) the pulse rate also showed a corresponding change from 72 to 120 beats per minute. DeBeer and Hjort²⁴ reported an average of 80.49 beats per minute for normal, resting dogs. In the remaining experiments, the rate was increased in four and decreased in six. These pulse rates were obtained directly from the pressure tracings in all cases.

Pressures were recorded at various intervals during each experiment. It would have been of interest to make continuous records, but this was found to be impracticable. Recordings were, however, taken at frequent intervals. The short wave diathermy was discontinued at various points during the experiment and the pressures were obtained immediately before the current

was turned off, while the current was off, and after the current had been turned on again.

In most instances no significant changes occurred at any time throughout the entire experiment. This was true for both systolic and diastolic pressures. These values are comparable to those of Brewer, Hamilton and Brotman²⁶ found in normal, lightly morphinized dogs (systolic 160 to 220 mm. of mercury, diastolic 70 to 110). The chart (fig. 2) and tracings (fig. 3) taken from experiment 42 illustrate the usual changes noted in this series of experiments.

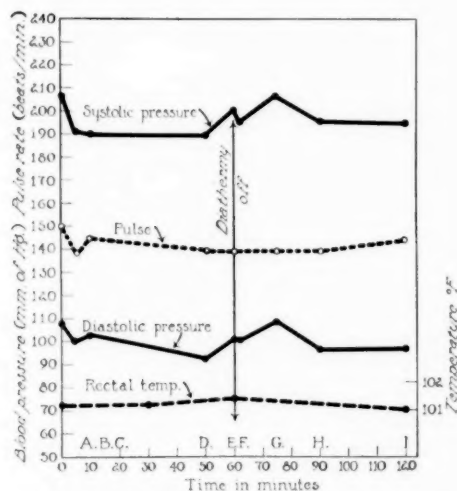


Fig. 2. — Changes in systolic and diastolic pressures and pulse rate when the application of short wave diathermy was accompanied by no appreciable rise in rectal temperature.

It will be seen from table 1 that but one significant variation in systolic pressure — a decrease of 11.9 per cent — existed after sixty minutes of short wave diathermy irradiation, as compared with the values obtained immediately prior to the application of the diathermy current. No significant change was noted in diastolic pressure. A variation of ± 10 per cent is considered within the normal range.

Little difference is noted between the control rest pressure and those pressures recorded at the end of the diathermy irradiation. The greatest variation in diastolic pressures was but 10 mm. of mercury in experiments 3 and 5. In experiment 3 this was an increase and in experiment 5 it was a decrease over the control rest pressures. The systolic pressure showed a somewhat greater, but inconsistent change, in that a drop of 21 mm., in experiment 17, and a rise of 13 mm., in experiment 2, were the extreme variations.

Results Obtained with Hyperpyrexia Induced by the Head Cabinet Alone. — These experiments were carried out primarily as a control to those in which fever was induced by the combination of short wave diathermy and the head cabinet. However, the effect of this method on the pulse rate and arterial pressures proved to be of such interest in itself that nine experiments were performed. As mentioned previously, the head and neck of the dog were enclosed in the cabinet heated to 45 C. (113 F.). The animal's rectal temperature was raised between 3.3 and 7.0 F. (1.8 to 3.9 C.). In experiments 22 and 28 the fever was allowed to rise to 109.0 F. (42.8 C.), and in five

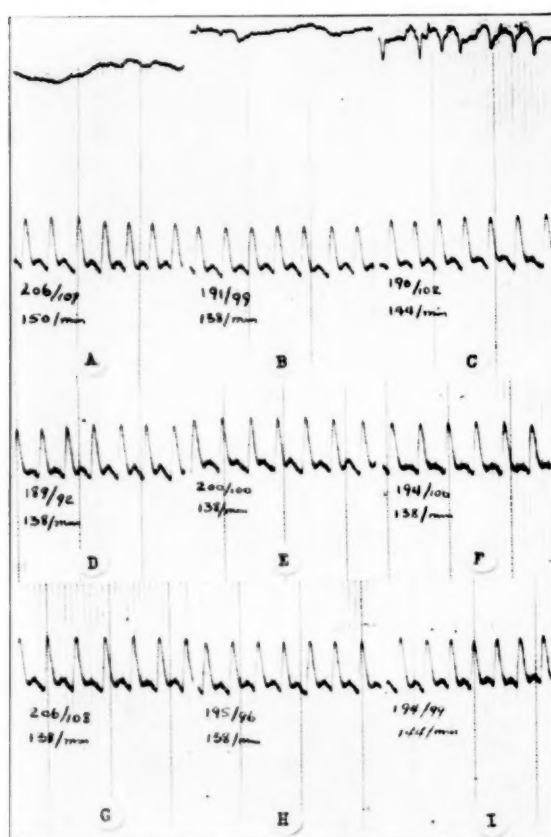


Fig. 3. — Portions of photokymographic tracings taken at various intervals during experiment 42. The letter beneath each tracing corresponds to one of the letters along the base line of figure 2.

others, to approximately 107.0 F. (41.7 C.) or slightly higher. The time required to raise the temperature to 107.0 F. or more varied from fifty to sixty minutes.

TABLE 2. — *Changes in Temperature (Fahrenheit), Pulse Rate Per Minute and Arterial Pressures in Millimeters of Mercury Induced by the Head Cabinet Alone.*

Experiment	Temperature	Period of Rest		Time, Minutes	Temperature	Period of Highest Rectal Temperature		Change in Pulse Rate Per Degrees F.	Percentage Change in Pressure	
		Pulse	Pressure			Pulse	Pressure		Systolic	Diastolic
16	102.3	120	166/84	30	106.0	120	175/86	0.0	+ 5.4	+ 2.4
19	102.2	160	227/124	25	105.5	120	220/100	12.1 dec.	— 3.1	—19.2
22	102.0	108	199/99	55	109.0	120	288/129	1.7 inc.	+44.7	+30.3
24	102.6	102	170/97	56	107.2	126	180/102	5.2 inc.	+ 5.9	+ 5.0
28	102.4	84	241/107	65	109.0	78	227/90	0.9 dec.	— 5.8	—15.9
34	103.0	90	191/87	60	107.6	98	194/92	1.7 inc.	+ 1.6	+ 5.7
41	101.2	120	220/104	50	107.6	102	148/118	2.8 dec.	+12.7	+11.5
43	101.3	104	Carotid	50	106.9	108	174/122	0.7 inc.	+33.8	+27.1
			Femoral							
			171/98				209/118		+22.2	+20.4
44	101.5	132	Carotid	60	107.0	100	154/92	5.8 dec.	— 8.3	— 2.1
			Femoral							
			189/90				186/90		— 1.6	— 0.0

The results are shown in table 2. In six of the nine experiments (66.7 per cent), both diastolic and systolic pressures were increased during the

period of highest fever. In the remaining three (33.3 per cent), the systolic pressure was lowered. In two of these, the diastolic pressure also decreased, and in the remaining one, it was unchanged. The increase in diastolic and systolic pressures was, however, significant in three (33.3 per cent) of the experiments. A significant decrease in diastolic pressure was noted in two experiments, and no significant decrease in systolic occurred.

The changes in the contour of the pressure tracings during the variations in the animal's bodily temperatures are extremely interesting. Chart (fig. 4) and tracings (fig. 5) were taken from experiment 41 and clearly reveal these typical changes.

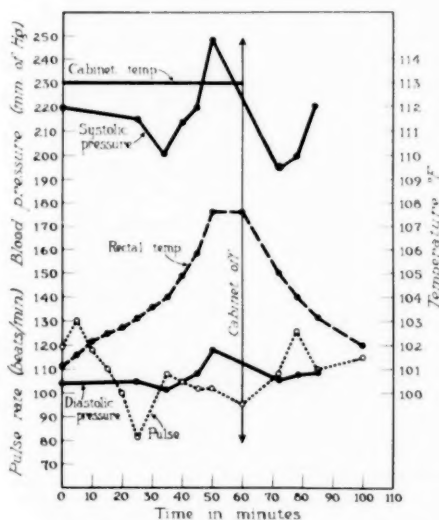


Fig. 4. —Changes in systolic and diastolic pressures, pulse rate and rectal temperature when fever was produced by means of the head cabinet alone.

The normal rest tracing (*A*) in figure 5, shows the usual femoral artery pressure curve. The first wave has a large amplitude and rises to its peak early in systole. This curve then falls very quickly, almost to its base line, after which it rises again as a distinct dicrotic wave.

As the temperature increases (*B*, *C*, *D* and *E*) the systolic ejection becomes increasingly violent with an abrupt rise to systolic height, and an equally abrupt fall. This fall is broken near its base by one to three (or even more — five being seen in several instances) sharp waves of falling amplitude which probably represent the predicrotic, dicrotic and postdicrotic waves demonstrated by Wiggers.²⁷

At the height of the fever all these changes were amplified (*F*). The individual levels of neither the systole, measured at the highest point in the rise, nor of the diastole, measured just before the beginning of systolic ejection, are constant. In such instances the average of twenty consecutive readings was taken as the representative pressures. (Usually only the average of ten consecutive readings was taken). The tracings *G*, *H* and *I* show prompt return to the normal contour as the bodily temperature subsided.

The pulse rate variations with increased bodily temperatures are interesting and will be discussed in greater detail later. In only four of the nine experiments was the rate of the point of highest fever greater than the one during the normal resting period. Only in experiment 24 could this be of any significance, and here the rise from 102 beats per minute to 126 was

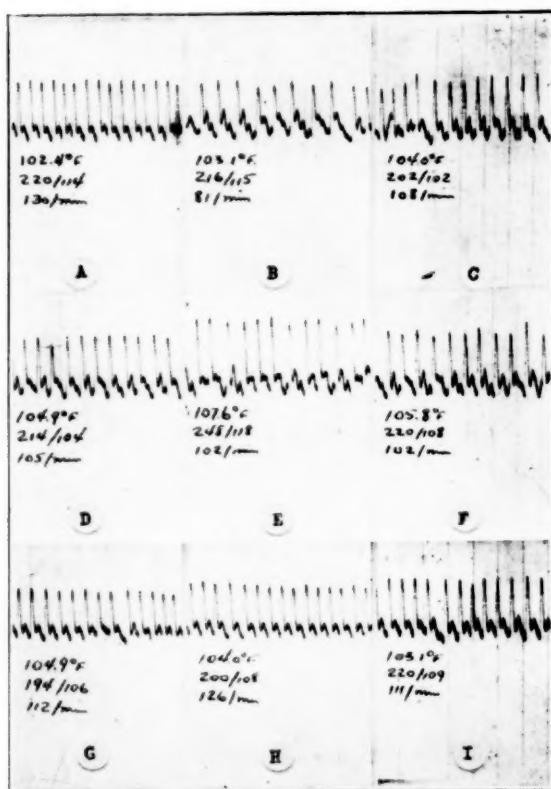


Fig. 5. — Portions of photokymographic tracings taken at various intervals during experiment 41. The letter beneath each tracing corresponds to one of the letters along the base line of figure 4.

but a 23.5 per cent increase accompanying a rise of 4.6 F., or 5.2 beats per degree rise in bodily temperature. The next greatest rise was but 12 beats accompanying an increase of 7.9 F., or less than two beats per degree rise.

The decrease in pulse rate was more striking, and occurred in four of the nine experiments. In one of these it was but 6 beats per minute, but in the others it ranged from 18 to 40 beats per minute, a decrease of 12.1 to 2.8 beats per degree rise in bodily temperature (Fahrenheit). The pulse rates shown on the preceding charts are good examples. No consistent relationship between pulse and pressure variations can be determined.

In this series of experiments, the evidence indicates that during hyperpyrexia induced by this method the arterial pressures tend to be increased. This was noted particularly in the systolic pressures, thus bringing about an increase in pulse pressure. The contour of the arterial tracing at the height of fever shows a markedly increased systolic ejection curve, which, however, cannot be taken as evidence of increased stroke volume. The pulse rate tended to decrease with the heightened temperature, but no constant relationship between pressures and pulse was indicated.

Results with Fever Induced by Short Wave Diathermy. — As mentioned previously, the head cabinet, heated to 36 C., was used in combination with the high frequency irradiation partially to inhibit heat dissipation by panting when hyperpyrexia was desired. The results obtained by this method (table 3) are similar in most respects to those found when the cabinet alone was used.

TABLE 3.—Changes in Temperature (Fahrenheit), Pulse Rate Per Minute and Arterial Pressures in Millimeters of Mercury Induced by Short Wave Diathermy and the Head Cabinet Together.

Experiment	Period of Rest			Period of Highest Rectal Temperature			Change in Pulse Rate Per Degree F.	Percentage Change in Pressure	
	Temperature	Pulse	Pressure	Time, Minutes	Temperature	Pulse		Systolic	Diastolic
21	103.1	170	187/96	40	107.5	120	-11.4	+21.4	+ 5.2
23	102.8	126	184/93	90	107.7	108	- 3.7	+14.7	+20.4
27	101.6	156	195/102	60	107.4	300	+24.8	-25.1	- 2.9
29	102.6	98	182/84	97	107.8	120	+ 4.2	+ 9.9	+16.7
33	102.2	84	195/88	70	107.8	76	- 1.4	+ 8.7	+ 1.1
35	101.6	136	172/86	90	106.8	104	- 6.1	+17.4	+29.1
36	102.6	82	140/70	50	107.2	108	+ 5.7	+29.3	+25.7
37	102.2	70	186/82	45	107.8	88	+ 3.2	+17.2	+ 9.6
38	102.2	132	176/90	75	107.3	142	+ 2.0	-10.2	-12.2
39	101.8	144	192/134	105	107.0	220	+14.6	-11.9	- 6.7
40	102.6	92	226/112	50	107.6	100	+ 1.6	+22.2	+ 1.8

Experiment 37 (fig. 6) is a good example of the average changes found in this group of cases. In figure 7, *A* shows the normal rest tracing. This can be considered a good basal level because of the slow, arrhythmic pulse rate and low femoral pressures. This tracing is also interesting in that

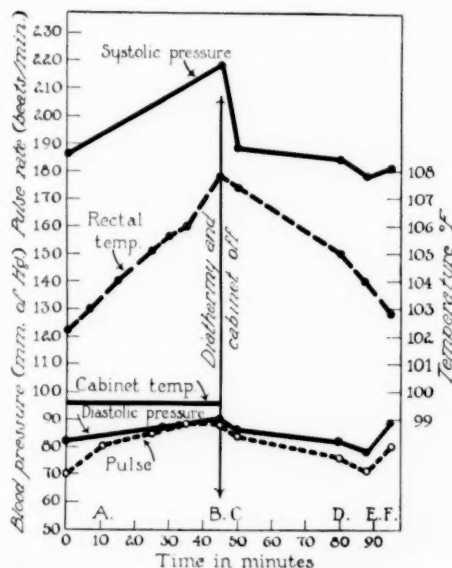


Fig. 6.—Changes in systolic and diastolic pressures, pulse rate and rectal temperature when fever was produced by means of a combination of the head cabinet and short wave diathermy.

several small waves follow immediately after the diastolic wave. These several waves are very frequently seen during high fever, but are infrequently normal. *B* indicates the pressure tracing taken when the fever had risen to 107.8 F. (42.1 C.). The pressure has increased 32 mm. (17.2 per cent) systolic, and 8 mm. (9.7 per cent) diastolic. The pulse rate increased from 70 to 88 beats per minute, or 3.2 beats per degree rise in bodily temperature (Fahrenheit). The contour is similar to that shown in *A*, but each wave is greatly exaggerated in amplitude. The systolic and diastolic levels vary greatly, and here again an average of twenty consecutive measurements determined the pressure values.

In each of the eleven experiments the rectal temperature was elevated to approximately 107.0 F. (41.7 C.), or above. This required from 40 to 105

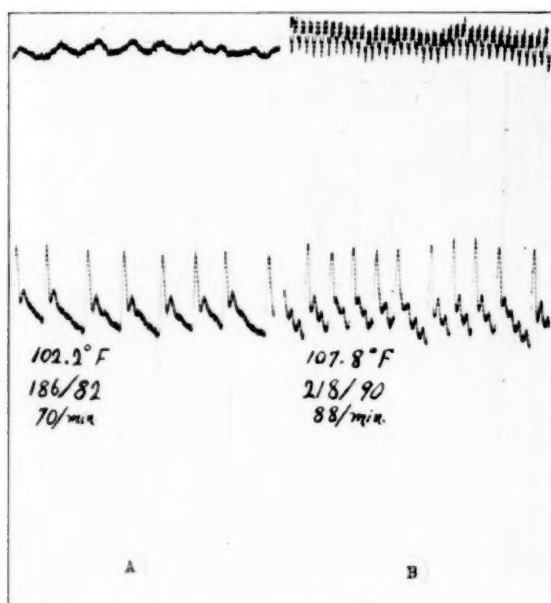


Fig. 7. — Portions of photokymographic tracings from experiment 37 taken at points A and B as shown in figure 6.

minutes. At the period of highest fever, which corresponded in all cases to the maximal period of irradiation, the systolic and diastolic pressures were elevated in eight experiments and lowered in three. The systolic pressures increased significantly in six (54.6 per cent), and diastolic in four (36.4 per cent). The systolic pressure decreased significantly in three (27.3 per cent), and the diastolic in one (9.1 per cent). The systolic and diastolic pressures were significantly elevated simultaneously in three experiments, and lowered in one.

Study of the maximal pressure changes during any part of the experiment discloses only two significant changes above those occurring during the period of total irradiation. In experiment 23, an increase of 30.1 per cent over the resting level occurred four minutes after the diathermy was discontinued, following total irradiation time. In experiment 29, an increase of 44.0 per cent took place after sixty minutes of irradiation.

The pulse rate increased in seven of the eleven cases, and decreased in the remaining four. In experiments 27 and 39 the increase was marked, amounting to 24.8 beats and 14.6 beats per degree rise in temperature. However, in both these experiments the animals were in apparent trouble, as evidenced by deep gasping respirations and intense restlessness. Their pressure tracings were highly irregular and differed markedly from those of the other animals. Both of these animals were old, as evidenced by their teeth and coats of fur. These tracings are taken from experiment 27. If we exclude these two animals, we find that in none of the remaining five was the pulse increase of any moment. The greatest of these was 5.7 beats per degree rise.

Of the four cases in which the pulse was lowered during the period of highest rectal temperature, we should disregard experiment 21 in which the resting pulse was 170 beats per minute, and thus far in excess of the normal range for the dog. Of the remaining three the greatest drop amounted to 32 beats per minute, or 6.1 beats per degree rise in temperature (Fahrenheit).

Comment

The failure of short wave diathermy to induce appreciable hyperpyrexia in the dog is most likely explained by the fact that in these experiments the animals received no sedative of any type. The mechanism of heat dissipation in dogs is quite different from that in man. Because of the lack of cutaneous sweat glands (except over small areas in the foot pads) the excess bodily heat is dispersed mainly through the respiratory system.²⁸ This mechanism is made particularly efficient through the phenomenon of panting. Anrep and Hammouda²⁹ showed that anesthesia (or sedation) delays the onset of panting in dogs, and that with moderate anesthesia a considerable rise in bodily temperature must occur before panting begins. Deep anesthesia abolishes panting entirely. It would have been possible to raise the bodily temperature quite easily by the application of the high frequency current if the animal had been given morphine and barbital sodium (intravenously) as in Wiggers¹² experiments. However, simply inhibiting heat dissipation by surrounding the dog's head with warm, moistened air has an advantage, since it avoids the use of anesthesia or sedatives which, because of their lowering effect on the blood pressure, might mask the true response to short wave diathermy.

The dog's means of dissipating heat primarily through the respiratory system might help to explain in some part the reaction of the blood pressures during hyperpyrexia. It is conceivable but not proved that an increase in bodily temperature, which initiates panting, also brings about pulmonary vasodilatation accompanied by both increased volume and flow of blood through the capillary bed to enhance even further the efficiency of this mechanism. If we could assume, then, that little or no change took place in the caliber of the peripheral vessels, when only the air in the respiratory tract was warmed, this might explain the maintenance of the diastolic pressures at a level only slightly greater or less than the normal resting values. The increased volume of blood flow through the pulmonary system would result in a greater necessary systolic output.

Why the heart responded by an increased force of systolic ejection as seemed evident in the pressure tracings, rather than by an increase in rate of contraction, we are at a loss to explain. The only two dogs, mentioned above, whose pulse rates did increase markedly were obviously in trouble, apparently because they were old. They became unusually restless and their respirations lost the smooth panting rhythm, becoming slow, deep and irregular. Early respiratory failure seemed imminent. Lest it be thought that application of short wave diathermy was responsible in some way for the untoward reactions encountered in these dogs, fever to 108.5 F. (42.5 C.), by means of the head cabinet alone, was produced in one of these animals one week later, and a similar pulse and respiratory reaction again occurred.

The failure of the pulse to increase appreciably as the bodily temperature was raised is not easily explained. It might be connected with a ratio said to exist between the pulse rate and the cutaneous temperature. This ratio was noted by Benson,³⁰ and by Phillips and Shikany.³¹ Benson stated that, theoretically, fever could be induced without increasing the pulse rate.

The body of the dog, heated by the head cabinet alone, was exposed to room temperature; however, when short wave diathermy was added, the skin must have been heated somewhat. In Knowlton and Starling's³¹ heart-lung preparation the dog's heart was shown to respond to an increase in the venous inflow by an increase in the ejected volume of blood, rather than by acceleration of rate. Brown, Alt and Levine,³² using conventional diathermy with plates strapped over the chests of rabbits and dogs, stated

that they noticed some tendency to a slowing in heart rate, usually associated with an elevation in blood pressure. This would be in agreement with Marey's law, but this law does not consider any change in bodily temperature.

Summary

Thirty-eight successful experiments were performed on twelve trained dogs. The arterial pressures were recorded on a photokymograph with a Hamilton manometer.

Eleven dogs were irradiated between large, air-spaced, plate electrodes of a short wave diathermy apparatus, operating on a wavelength of 16.6 megacycles, for periods varying from fifteen minutes in one experiment, to sixty minutes in five. No constant, significant change was noted in rectal temperature, arterial pressures or pulse rate, at the end of the period of irradiation, as compared with those found in the resting dog. Several marked variations in arterial pressures were observed during, and following, irradiation, but these were highly inconsistent in themselves, and could not be repeated in the same or similar experiments.

In nine experiments, the rectal temperature was elevated to between 105.5 and 109.0 F. (40.8 to 42.8 C.) by a heated (113 F. [45 C.]) and humidified cabinet placed over the animal's head. In three of these, or 33.3 per cent, the systolic and diastolic pressures were significantly increased (that is, more than 10 per cent variation from the resting values). In two, 22.2 per cent, the diastolic pressure decreased significantly, but there was no decided decrease in the systolic pressures. The pulse rate was increased more than five beats per minute for each degree rise in temperature (Fahrenheit), in only one experiment, but was decreased more than this amount in two.

In eleven experiments hyperpyrexia was induced by short wave diathermy and the head cabinet to approximately 107.0 F. (41.7 C.). The systolic blood pressure was elevated significantly in six of the eleven (54.6 per cent), the diastolic in four (36.4 per cent). The systolic was decreased significantly in three (27.3 per cent), and the diastolic pressure in one (9.1 per cent). The pulse rate increased more than 5 beats per minute, per degree Fahrenheit rise, in only one experiment, and was decreased likewise in only one.

It is concluded that there seems to be no consistent, appreciable difference in the reaction of the pressures of the femoral artery, whether hyperpyrexia is produced by raising the temperature of the air the animal breathes, or by the general bodily application of short wave diathermy.

No adequate explanation can be offered for the failure of the pulse rate to increase consistently as the bodily temperature is elevated.

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Discussions of Papers by Drs. R. L. Bennett, et al., and H. G. Brugsch*

Dr. Disraeli Kobak (Chicago): The authors are to be commended for both an objective and highly critical study in a field where a great deal of confusion still exists both in theory and practice. It is recalled that ever since diathermy came upon the scene as an agent for the deep heating of tissues, the imagination of some of its proponents exceeded the speed of experience and accordingly, many implications were written into the literature of this subject whose validity was based on no more concrete a fact than evidence founded on mere argumentation or the accident of uncontrolled clinical experience. It is therefore not to be wondered at that the affirmations of past efforts have often been knocked down by the more critical efforts of recent date with an ease that has made us skeptical of its clinical value. I have the impression that future generations will evaluate our period as the age of skepticism, the age of medical iconoclasm where nothing is more respected than facts, and their correlation into an exact science its desideratum. In this instance Bennett and his coworkers represent the personality that has entered the modern field of physical medicine. The only question that may be challenged is not the method of study, but choice of subject. It is worth while speculating whether this study could not have been enhanced by incorporating an evaluation of the action of short wave current on actual clinical material, material that suffered from high blood pressure and had been controlled by all the exact means at the disposal of such a rare institution, the Mayo clinic. The point I wish to stress is that the method must not only be objective but realistic. If one studies the effect of drugs on the pain syndrome, one should rationalize the problem to its logical conclusion. It is like carrying coal to Newcastle to point out to the joint authors that all the pain relieving drugs introduced into a normal human will not elicit the data searched for, and it appears to me to be but a logical corollary that to arrive at a clinical evaluation of the influence of short wave diathermy on arterial pressure one should select material suffering from this symptom and evaluate it in its broadest scope, at the laboratory and the bedside. Such was the reported procedure by Vannotti and to a lesser extent by Hertzman and his coworkers. The contradiction in action observed by these authors calls for an elaborate and controlled study as objective and critical in its extent as Bennett and his coworkers have used in their study. The negative conclusions arrived at by the last group are a positive contribution and should be considered as an excellent guide for future workers in this field.

Dr. Brugsch has presented a thought provoking review related to certain unknown effects of ultrashort wave radiation on living material. Whether the effects

described are due to the consequences of overheating of tissues subjected to overlong or overintense treatment, or whether there actually exists a side effect similar in threat to the stray radiation associated with x-ray phenomena is a debatable question. If I should attempt to pass judgment of the side effects of ultrashort waves based on personal experiences I think it would largely be a compromise between impressions and convictions; that is to say, it would depend on certain elusive experiences in which my conscious state would respond or react to a host of impressions as far removed from the actuality of short wave bombardment as are the intangible effects of suggestive therapy in clinical practice. During the many years in which I have been patient, guinea pig and in the neighborhood where treatment by short waves has been administered, I have more or less experienced every form of reaction noted by Schliephake and others. I have no doubt that if one could question a large or extensive cross section of our profession one would also extract information that parallels the reactions ascribed to short wave but with the difference that these were obtained by every imaginable form of therapy known to mankind. If the basis of short wave therapy is a physiologic response of living substance due to thermal influence, it is difficult to explain most of the bizarre reactions mentioned in the literature except as created by one's imagination. It is not an uncommon thing for susceptible individuals to suffer from any one of a train of symptoms that begin with disagreeable sensations, such as headaches and include a variety of psychoneurotic symptoms in which restlessness, excitability, mild fears, depression or pessimism play an important role. The dentist tells a similar story of patients who develop or lose their pain while waiting for his ministrations. The mind is prone to play us strange tricks in the presence of the unknown, and it is difficult to evaluate the actualities of this relatively new group of radiations by implying strange or mysterious possibilities or being over dogmatic at this period of our experience. Personally, I have felt no different before and after a day's work amidst a field of short wave transmission. I have had headaches because of financial and other worries and have been elated and depressed on many occasions long before I was introduced to short wave therapy and under circumstances far removed from its influence. And yet it has recently come to me through Dr. Davidsohn at Chicago, that she has observed a definite influence of short waves on the menstrual cycle in three of her technicians. I feel that we ought to take the stand along lines suggested by a Gilbert and Sullivan couplet: "What never? Well, hardly ever."

In the majority of instances the side effects mentioned by Brugsch and supported by others are effects following the use of short waves that are either physiologic in

* Paper of Dr. H. G. Brugsch appeared in the March, 1941, issue of the ARCHIVES.

action or those beyond physiologic limits. The sedative action of heat is no stranger to human experience. Patients will fall asleep under many forms of heat treatment, will manifest signs of dizziness, sweating, pallor and changes in pulse and respiration-reactions due to heat on the neurocirculatory apparatus and not to a mysterious side effect. The sedimentation rate becomes more rapid, but so also does it happen when fever treatment is administered. Patients may develop burns of a local character due to intensive concentration of short waves in sweaty neighborhoods, this particularly in oral treatments and on skin surfaces where the parts have not been protected against moisture. Altogether I think the lesson brought home by Dr. Brugsch is that short waves in therapy are prone to evoke deleterious results if not used under the guidance of a physician experienced in its use and a knowledge of the disease under treatment. It is unfortunate that it is today the popular opinion that short waves are as innocent in their effects as they are innocent of potential dangers. The author's message is therefore a timely warning against its abuse.

Dr. W. B. Seymour (Cleveland): In the past, attempts have been made to reduce hypertension in humans by short wave irradiation of the carotid sinus, brain stem, skeletal muscles, and liver. The observations have been random and uncritical. This paper is one of the few in which an attempt has been made to control experimental conditions, and critically evaluate results.

Dr. Bennett and his colleagues have shown that short wave irradiation alone has no effect on the blood pressure, again confirming the non-specific effects of short waves in the absence of heating. Furthermore, hyperpyrexia, whether induced by prevention of heat loss, or by a combination of prevention of heat loss and short wave irradiation, has no specific effect on blood pressure or the pulse in the dog, although definite changes occur. Significant changes in blood pressure are difficult to evaluate in dogs when they are panting: the rapid change in intrathoracic pressure, and the mechanical effects of pressure of the thoracic viscera cause changes in pressure on the wall of the aorta itself, and possibly a very large number of pressure readings must be averaged to obtain a statistically significant difference. Similarly, changes in the dog's pulse rate are difficult to evaluate, because of the normally great sinus arrhythmia.

Dr. Bennett and his colleagues have shown that the dog truly is a difficult animal upon which to evaluate the vascular response to hyperthermia, and it is certain that they would not attempt to apply their results to humans, in whom the heat dissipating mechanism is so different from that of the dog.

Dr. F. H. Krusen (Rochester, Minnesota): I have been deeply interested in the presentation of Dr. Bennett. The care with which this work has been done speaks for itself. The fact that it disagrees with the authoritative studies of

Wiggers can be explained, I think, by the difference in technic and the fact that in Bennett's investigation no anesthetic was used. If I am wrong, I wish Dr. Bennett would correct me.

The fact was brought out by the previous discussors that certain vague symptoms were described by Schliephake and others, so lacking in clarity that they are of little significance.

I wish to add my own opinion to that of Dr. Kobak. For the past five years we have run at least a half dozen of these devices daily, with a group of thirty or forty workers, and none of our staff observed the vague headaches and discomforts which Schliephake mentioned rather casually without any definite proof.

I should like to ask Dr. Brugsch if he could get his colleague who thinks he can tell when the diathermy machine is on, to permit some definite experiments on himself in an attempt to learn whether this is or is not true. He might also ask the technician who had to leave the department because she had headaches to submit to some careful studies in order to determine whether the short wave diathermy is actually the cause of her headaches.

I agree most thoroughly that to date the only effects on the human being, which can be attributed to diathermy are those due to heat, although we cannot deny that there may be other effects.

Hemingway and Stenstrom recently recommended that we make still further studies to attempt to confirm or deny the presence of athermic effects, and any studies along these lines which we can obtain will be of value. At present we must continue, I think, to hold the opinion that in human beings the only effects produced by conventional or short wave diathermy, are those attributable to the heating which is produced.

Dr. Frank H. Ewerhardt (St. Louis): I would like to report one burn which I caused on a patient, and it taught me a lesson. It was quite a number of years ago. I put a cast on a broken leg encasing the entire foot, up to the thigh. That was in the early days of short wave therapy. It was thought, for some reason, if he had severe pain he should be subjected to short wave therapy. I created a burn that certainly was an inch in diameter in the popliteal space. Since then I have never applied short wave to a cast.

Dr. William Bierman (New York): With reference to the side effects, it is obvious that they are those of any agency which produces an active hyperemia. I can say, along with the other discussors, that we have made very extensive use, during the past decade, of this form of treatment, and we have never seen any sad results. Of course, one can get distressing complications if one applies this or any other heat-producing procedure to an acute inflammatory state.

With reference to non-specific effects, until somebody can conclusively prove that there are changes which occur clearly from some non-thermal influence, we will have to stick to the thermal idea.

SHORT WAVE DIATHERMY IN TREATMENT OF GINGIVITIS *

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The problem of inflammatory and certain infectious processes of the gums and teeth has long been unsatisfactory from the standpoint of therapeutic result. In spite of the progress made by modern dentistry these conditions often have proved refractory to various forms of topical medication and dental care. With a view of determining whether short wave diathermy would prove more effective than the methods now employed a study was made with various technics on a series of 64 patients suffering from gingivitis and certain types of apical abscesses which include also what is commonly referred to as incipient pyorrhea. At the outset it was realized that while this problem is of especial importance to dentists, it is also one of scientific and clinical interest to the medical profession. As a matter of fact in a number of instances in the series studied it was found advantageous to have the cooperation of dentists for the purpose of placing the affected teeth and gums in the best possible condition in order to render them most amenable to the effects of short wave current.

From a purely theoretic point of view there is a justifiable reason for this type of experimental work, because its rationale rests on the physiologic basis of active hyperemia. However, the first few observations proved disappointing, and it soon became apparent that the initial technic would have to be altered perhaps by empirical trials, until the most practical method to attain satisfactory results would be found. As was to be expected, the first efforts were rather crude in concept and execution, necessitating repeated changes in equipment and technic until the best available though by no means ideal form could be obtained. Before reporting the first shortcomings and the method eventually selected, it is deemed advisable briefly to review the underlying problem.

Nature of Problem

Throughout life the gums and teeth are subjected to recurring stresses induced by infection and trauma which eventually produce important changes in the health and comfort of nearly every individual. Gingivitis is the first of a series of seven pathologic episodes classified under paradentosis which if neglected, eventually provoke degenerative and progressive changes that terminate in pyorrhea and the loss of teeth. It must be stressed that gingivitis is a dento-systemic involvement of concern to both the dental and medical profession, because it touches and influences every phase of human health. Limited to the fibrous tissue covered by mucous membrane in intimate relation to the alveolar processes of the upper and lower jaws that surround the teeth, its insidious and painless progress is an ominous sign of failing health. The warning signal is the pink toothbrush and bleeding gums that render the patient an easy victim for all the dental fads and fancies sold over the counter, until that time when he is forced by ceaseless discomfort and pain to seek the aid of the dentist, or because of metastatic involvements, the advice of the physician.

* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 4, 1940.

The comparative ease with which short wave diathermy has been found to control the early stages and advances of this disease suggests the need of differentiating gingivitis and preparadentotic states from the progressing types of paradentosis that end in the classic picture of hopeless pyorrhea. The causative factors no doubt are as obscure as they are mixed. Behind the systemic background there is probably a combination of maladjustments provoked by local irritants of a mechanical, bacterial or chemical nature, including calculus and abnormal biting stresses. This causes inflammation and hemorrhage of the gums which if neglected, initiate certain degenerative processes such as purulent pockets, migration and loosening of the teeth, and the like. The earliest diagnostic signs are the congested color and swelling of the gums, and their tendency to bleed on gentle pressure. The roentgenographic film is frequently a great aid, for it shows resorption of the alveolar margins, while the gingival crevices and pockets may be filled with bacterial deposit.

Unquestionably the conventional treatment practiced by the dental profession has great merit. The standard method is surgical intervention by removing detached and unhealthy tissue from the neck of the teeth by incision or electrocoagulation, followed by scaling and polishing and applying a cement-like substance around the neck of the tooth before the gingival margin has regenerated. The fact that a certain part of this procedure apparently violates a rule of surgery; namely, the prevention of proper drainage, and is furthermore associated with a degree of pain and objectionable discomfort during convalescence, suggested the trial of short wave diathermy because of its known pain relieving and healing action in inflammatory processes.

Based on its physiologic action on chronically diseased tissues, short wave treatment offers ample reasons for its clinical use in the presence of accessible inflammatory and infectious processes. Its superiority over mouth washes and oral disinfectants can be readily appreciated when it is recalled that astringents and disinfectants no matter how tastefully disguised or bactericidal in quality are limited to a surface action. On the other hand short wave diathermy by its endogenous deep heating property invokes a train of reactions that tend to transform degenerative into regenerative states.

Clinical Orientation

My clinical interest in gingivitis and incipient paradentosis was stimulated when, in 1934, three dispensary patients, of whom two gave a history of cervical and brachial arthritis and one of vague neuralgic pains about the face, presented themselves for re-examination because of the persistence of symptoms despite a period of routine treatment. Because both patients with arthritis also suffered from definite chronic gingivitis and the third from incipient pyorrhea with loose teeth and tender gums, a series of six short wave treatments was prescribed on an empirical basis. Relief from pain was perhaps more pronounced in the patient with neuralgia, so that his teeth apparently became more firm and chewing less restricted. Roentgenograms taken three months later indicated moderate healing of the alveolar process as compared to the original film. The impression was that he had obtained considerable symptomatic relief. The other two of this group whose condition was diagnosed as gingivitis showed definite improvement in the color and firmness of the gums, but with little clinical changes in their arthritic state. Although the results were hardly of a degree to arouse enthusiasm, the relief of pain and increase of dental function plus the objective signs of tissue changes toward the normal stimulated further investigation of this problem.

In the beginning the relief obtained was more or less temporary because it followed a technic which was faulty and even hazardous. The customary condenser pads were either oversized or undersized and proved impractical for comfort and ideal apposition to the affected site. They produced localized hot spots that demanded speedy interruption of treatment. The heat was sensed more on the surface than in depth and seldom was a patient able to endure twenty minutes of treatment because profuse perspiration concentrated the heat to a disagreeable degree. Apparently no pads between the condenser electrodes and skin could meet the required dosage measured on the basis of borderline tolerance. From this it gradually became evident that a standard technic had to be attained which could either be separated from a blind dosage that depended wholly on the patient's sensations or mechanically protected him by a dosage control that would overcome the high temperature of the skin and underlying tissues and produce uniform and tolerant heating throughout the depth.

It will be recalled that when three layers composed of muscle, fat and lung tissue are radiated transversely and longitudinally by air-spaced and contact condenser electrodes, the heating of these structures is by far more uniform or homogeneous under the air-spaced method. It is the underlying fatty buffer in living tissue that has been found to acquire the greatest temperature and accordingly this and the increasing perspiration on the skin are the usual hazards that prevent deep and long heating of the underlying structures. While the induction coil technic has proved the best procedure to produce minimal heating of fatty tissues, it was discarded because of its impractical size, bulk or weight. The method that proved most ideal was that of small air-spaced electrodes fixed to or placed in proximity of the part selected for treatment, or that of semi-rigid curved condenser electrodes with perforated felt padding. Thus, while still far from the ideal, this technic is now utilized and will be replaced when direct labio-lingual electrodes shall prove practical. These require individual molds that still present annoying difficulties which probably could be overcome by the mechanical ingenuity of the dental profession.

It is realized that the problem requires the aid if not the total supervision of a competent dentist. The prophylactic measures preceding treatment as well as the differentiation of the early from the late types of paradentosis are best left to our dental colleagues. Such practical information as whether one deals with a primary condition of gingivitis or a progressing state with marginal resorption and secondary inflammation, suppuration, pockets and occlusal stresses has been found of importance for the projection of the amount of treatment and prognosis. The most satisfactory method of arriving at a diagnosis consists of passing a fine probe under the gum margin. In the early types of gingivitis one may see a formation of superficial pockets, that is, detachment of soft tissue from the roots, and bleeding on gentle probing. The signs of advanced paradental infection are an exaggeration of these symptoms to which should be added suppuration, change in color, hypertrophy and gingival recession. Treatment to be effective requires the removal of calculi and other products, and cleansing of the pockets before the use of short wave diathermy.

Technic

The preferred types of electrodes were of the air-spaced variety, though the semi-rigid ones with perforated felt permitted reasonably high intensity radiations without undue discomfort. Dosage, spacing and length of treatment play an important role for the end results. If the measure of dosage

is dependent on tolerance of the patient, the energy introduced must be sensed as a form of heat associated with mild internal pressure about the gums. The more recent technic incorporates a dosage control unit which replaces the "pinch and guess" method now in vogue. This dosimetry provides a calibrated orientation to deliver a constant dosage measured in watts. Spacing of the plates over cheeks or lips must allow for approximately 1 to 2 cm. distance, the electrodes of a curved shape to be placed tangentially to the cheeks. The average duration of treatment now is ten minutes. When this is prolonged as were the early cases, tenderness and pain about the teeth last hours to days. These reactions are ascribable to the hyperemia and congestion in the smaller blood vessels simulating a duplication of the prolonged dilatation seen in the web of a frog's leg and tongue after intense radiation. It is my impression that the molar region permits stronger or longer radiation because most of the discomfort has been reported about the incisors. The most recent example of this unpleasant complication is a young man with cardiac disturbance who came to us from the dental clinic with a diagnosis of acute gingivitis with poor dental occlusion. Treatment apparently improved both gums and the heart, but he began to complain of hypersensitivity of the gums to heat and cold which suggested that an over-dosage had created a congestion best to be overcome by rest.

Results of Treatment

Of 64 patients that completed treatment only 28 gave a diagnosis of gingivitis, 14 showed signs of suppuration and loosening of teeth, 6 had localized but marked swelling of the gums on the labial and lingual sides, 5 suffered from that painful and offensive odor designated as dry socket, and 11 had post-extraction pain and bleeding (table 1). Forty-two have since

TABLE 1. — *Gingivitis and Other Oral Involvements Treated by Short Wave Diathermy.*

	Number	Total Treatments	Average Treatment Per Patient	Symptomatic Relief Patients	%	Partial Relief
Gingivitis	28	140	5	22	78.6	6
Inflammatory Parodontosis	14	112	8	11	72.3	2
Local Infection (Granuloma).....	6	18	3	6	100	0
Dry Socket	4	12	3	4	100	0
Post-Extraction Pain	12	30	2.5	12	100	0

reported their status, which in the main indicated the value of the treatment. Symptoms of pain and tenderness were controlled in all patients, which apparently encouraged their sustained cooperation. Especially were these symptoms definitely relieved in the groups suffering from extraction trauma and hemorrhage and those from localized swelling. Among the latter group but not included in this report was a physician who presented himself with swelling of the upper gum due to a neglected apical abscess that distorted his face and spread to the pendulous portion of the palate. The pain was relieved in two hours and the swelled tissue reduced to a pronounced concavity without any evident drainage. A year later a dentist prevailed upon him to have his offending tooth removed which immediately resulted in an extension of the infection to the two adjacent molars, but the pain and tumescence were promptly relieved by short wave treatments.

Of the 42 cases of gingival and early parodontal involvement, over 60 per cent received prophylactic scaling and oral hygiene to eradicate infection and to relieve overstresses. As might be expected the number of treatments per patient was larger, but this provided the added certainty of reducing the tenderness, swelling and color to a normal state. The average

number of treatments for gingivitis and preparadentotic involvement was less than six and less than three for the remaining groups (table 1). Treatment produced considerable amelioration of both objective and subjective symptoms.

Summary and Conclusions

1. Gingivitis and associated dental conditions may be effectively controlled by short wave therapy without the trauma incident to surgical intervention.
2. The best possible results are obtained by a technic utilizing suitably sized air-spaced electrodes or special ones constructed to fit individual anatomic configurations.
3. Short wave therapy affords early relief of pain, soreness and distress by its hyperemic effects on inflamed and infected structures.
4. Dosage is determined by individual heat tolerance.
5. Of 64 treated patients more than 78 per cent of those with gingivitis, and more than 72 per cent of those with incipient paradentosis, became symptom free.
6. All patients suffering from granuloma, so-called dry socket, or post-extraction pain attained complete relief.
7. Cooperation between the dental and medical profession is essential.

Discussion

Dr. Frederick L. Wahrer (Marshalltown, Iowa): My interest in this type of work has been rather casual and my experience only occasional. The results have been somewhat difficult to evaluate because of the parallel treatment which was being done at the same time by the dentist who referred the work to me.

My original difficulty in these cases was to find an electrode with which I could at least partially treat these cases with some degree of efficiency. I took a circular air-spaced electrode of sponge rubber and with shears, I cut through the middle and constructed an electrode approximately two and a half inches long and about one inch in width. I tried applying this electrode through the lips and also directly to the gums. I found the same difficulty that Dr. Kobak experienced, that of the collection of moisture, with the resulting hot spots which interrupted the treatment.

I prevented that to some extent by the use of Kleenex, which I placed next to the gum or to the lip and between the electrode. This absorbed the moisture and to some extent eradicated the hot spots. It is my present procedure to use this on the outside of the lip rather than on the inside. I have found that when the moisture and saliva collect, patients soon have a mouthful of Kleenex, and to me it has not been as satisfactory as applying it through the lip. I feel I get just as good results in that manner.

It has not been my custom to give a ten-minute treatment. I have been using from six to seven minutes, and with perhaps one interruption during that time for the removal of moisture, I get through with it in fairly good shape.

I have had eighteen cases of gingivitis, pyorrhea in all states and four apical abscesses. I have found that the most satisfactory results have been in the relief of painful symptoms and a general increase in comfort in his or her mouth.

Apical abscesses perhaps have responded better than either pyorrhea or gingivitis. I have had some very nice results in cases in which the abscess was spontaneously drained and the teeth have become firm where they have been loose, and these few cases which I had, have given me a response much better than those with pyorrhea or gingivitis.

Dr. Kobak spoke of the fact that these cases of gingivitis, pyorrhea, apical abscesses, were poor from the standpoint they would affect one's general health. I have looked at this from just a little different angle, not that I do not agree with Dr. Kobak in this respect but I have felt that in many instances the gingivitis, pyorrhea, these apical abscesses often are predicated upon the underlying cause of other ill health in the body, and I have recommended that these men and women get general examinations to see if they do not have some other underlying condition which has been causing or at least been a predisposing cause in having such a condition occur in their mouth. I recommend to the patient that he have a general examination with this in view.

In the 18 cases which I have treated I have felt, and so has the dentist, that 11 of them gained definite benefit from the use of short wave diathermy. Now as I have stated, it is difficult to evaluate what the short wave diathermy has done in the face of parallel treatment coming at the same time by the dentist who necessarily

is working on the case along his particular line of treatment, but he has felt that the results in these eleven cases were definitely better than he was getting where he used his own treatment alone.

Dr. Walter J. Zeiter (Cleveland): I was very much interested in Dr. Kobak's presentation and I would like to point out that if diathermy is properly used in gingivitis and conditions around the mouth that good results can be obtained.

I believe one step forward that will help us to control the dosage and the amount of treatment to give these patients is the use of the dosimeter, with which we have a little better idea how much energy is being passed on to the patient. I think this will help us in stabilizing our treatments a little more, so when we discuss the use of short wave diathermy we will understand what we are talking about. I think the great tendency is to use excessive amounts of heat.

We have treated quite a number of conditions involving the eye. We were very cautious and we have found to undertreat rather than overtreat yields a better result. I think that holds true also for conditions around the gums.

I haven't treated any patients with gingivitis but I have a number with dry sockets, and in these I have found that low intensity heat is much better than excessive heat, which usually aggravates the symptoms.

We have used the induction coil entirely in these treatments and have had no particular difficulty with hot spots. Ordinary toweling for spacing absorbed the moisture. If excessive heat is not used, one will not have any difficulty, at least we didn't in about ten or fifteen patients.

One other condition that we have found diathermy helps is trismus following extractions. Three or four, usually two or three diathermy treatments secure relief. The number in which we have obtained relief runs about as Dr. Kobak has reported.

I think it is a very interesting presentation, and it is worth remembering when patients come along that they should be carefully controlled and followed up for some time.

Dr. Henry L. Sinskey (Baltimore): For Dr. Kobak's information, I think there are about twenty-five dentists in Baltimore who are doing that themselves but mostly for the surgical type. They are cutting the

gums. Instead of using diathermy, they use coagulation. One dentist by the name of Dr. Backler has been doing it for about six years and Dr. Kreiger, who unfortunately died, did some wonderful work in 1932. He used conventional diathermy at that time. Dr. Backler is still using conventional diathermy.

The dental firms have gotten out what they call a dental short wave diathermy apparatus. It happens my brother is a dentist. That is why I know that.

Dr. Disraeli Kobak (closing): My discussers have added to the paper. I quite agree that the problem at the beginning is usually difficult in anything we do, and the ideal thing never comes to us until by trial and error perfection is attained.

I don't know how to take issue with Dr. Wahrer about his point of view with reference to the examination of the patients for systemic diseases as a precursor because of focal infection. The theory of focal infection presupposes that a localized process usually produces metastatic involvement elsewhere. So far as we are concerned, we were never able to see a patient prior to that focal involvement. Patients never have come to the clinic with good health. They came because of other conditions and we find, as all very likely have found that frequently when you cure a focal infection, the distant involvement also is favorably influenced.

So it is my impression, as it has been of others, that focal infection of the teeth usually is a precursor possibly of other systemic involvements and should be taken care of. I don't think that focal infection is the whole story; but I think much could be said about systemic and constitutional derangements that no doubt influence the state of our gums and teeth.

I agree with Dr. Zeiter that the dosage control is a vital factor in any sort of treatment with short wave diathermy. That is the ideal in which we have tried to interest the medical profession. Last year we presented a study of certain observations of the effect of depth penetration and temperature variation within the tissues under dosage control.

Since in the concerned dental conditions we must use heavy dosage to obtain a pronounced sensation of heat within the gums, it is of importance for us to use an intensive energy as the only means of attaining effective results.



SYMPTOMATIC RELIEF IN CHRONIC AND ACUTE ARTHRITIDES BY HISTAMINE IONTOPHORESIS *

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MINNEAPOLIS

Iontophoresis as a method of introducing drugs into the body has been applied effectively to zinc solutions, copper solutions, silver nitrate, adrenalin, insulin, magnesium sulfate, and more recently, to desensitizing allergic patients. Harpuder¹ has used nupercaine by iontophoresis for blocking referred pain. Other conditions said to be benefited by drug iontophoresis are trachoma, chronic otorrhea, hay fever and various forms of rhinitis, indolent ulcers, scars and cervicitis.

Histamine iontophoresis was introduced by Deutsch² in 1931, as an efficient method of producing arteriolar and capillary dilatation of the smaller vessels together with increased permeability of the vessel walls. There is increased blood supply to the affected tissues, therefore increase in nutrition, metabolism, and temperature. Augmentation of blood supply is and has been commonly accomplished by indirect hyperemia induced by diathermy, counterirritants, hot water bottles and forms of infra-red radiation. Nerve section and ganglionectomy have been performed in certain severe cases of rheumatoid arthritis.

Pharmacology of Histamine

According to Sollman³ histamine or ergamine acid phosphate is found in all tissue extracts and is present in large amounts in the normal stool. It is a cleavage product of proteins produced by acids, ferments, or bacteria. It is rapidly destroyed by bacteria, therefore not effective when given by mouth. Subcutaneous or intravenous injections of histamine produce powerful effects on the circulation and smooth muscles. Bronchioles and large arteries are constricted, arterioles and capillaries are dilated.

Quantities of more than 1 mg. when injected may cause alarming symptoms consisting of headache, vomiting, fall in blood pressure, and respiratory disturbances.

Kling⁴ demonstrated the powerful influence of histamine on the peripheral circulation by putting a drop of a 1:1000 solution on the skin, then pricking the skin with a sharp needle. Within five minutes an urticarial wheal surrounded by a red flare developed. This demonstrated a triple reaction: "1. Local dilatation and increase in blood flow in the minute vessels (purple spot); 2. a local increase in the permeability of the capillaries, producing a wheal; and 3. a widespread dilation of the surrounding arterioles (flare)."

The above effects can be obtained by any method carrying the drug to the arterioles and capillaries such as injection, application of ointments or solutions and pricking of the skin. Scratches and needle pricks, however, produce bruises preventing frequent re-application, for which reason application of histamine by iontophoresis is a more satisfactory method. It is simple, harmless and can be accurately controlled.

* Read at the Nineteenth Annual Session of the American Congress of Physical Therapy, Cleveland, Ohio, September 6, 1940.

For this procedure a source of smooth galvanic current is used having an accurate meter reading to 50 ma. Histamine is an alkaloid and therefore carries the electrical charge toward the negative pole as it is an anion. The solution is for this reason applied at the positive or active pole which consists of filter paper soaked in a solution of 1:3000 strength and corresponding to the size of the area being treated. Over this is wrapped ordinary sheet wadding soaked in normal saline to prevent evaporation of the solution and this is held in place by a rubber Davol bandage. The negative or dispersive electrode consists of a padded lead plate placed on the chest, back, or abdomen as occasion arises.

Kling used a non-metal basin filled with physiologic salt solution in which an insulated metal plate was placed. One hand was immersed in the solution.

Following application of the electrode the current is turned on and gradually increased to a strength of $\frac{1}{4}$ to $\frac{1}{2}$ ma. per square inch for five minutes. If a galvanic apparatus is not available the scratch method may be used. A piece of gauze soaked in the solution is rubbed into scratches over the involved area.

Subjective and Objective Observations

As the current is turned on the patient notices a sensation of prickling as if being pricked with needles. The current is slowly increased to maximum and the prickling sensation is replaced by itching. When the current is turned off slowly the prickling sensation returns. As soon as the positive or active electrode is removed, the patient will complain of itching for ten to thirty minutes.

During treatment the skin becomes reddened and a flare appears around the treated area. On removal of the active electrode wheals appear in the red flare and may blend into one large patch of urticaria if iontophoresis is used. The skin temperature of the treated part rises 3 to 6 degrees F. The wheals or urticaria usually disappear in ten to thirty minutes leaving the reddened skin which returns to its normal appearance in three to six hours.

Studies by Bettmann⁵ showed a marked increase in the number of capillaries visualized as well as in the circulation rate, and dilation of sub-papillary vessels. Bettmann demonstrated experimentally that iontophoresis of a 10 per cent solution of sodium iodide preceded by an application of histamine showed, in sections, particles of iodine precipitated in all layers of the skin; whereas, when not preceded by a histamine application the particles were precipitated only in the superficial layers by thallium acetate. These experiments show that the action of the galvanic current is to carry histamine to the capillaries and arterioles in the corium. So far it is the most satisfactory carrier for this purpose. Controversy over how deep drugs can be carried into tissues by this method does not affect the use of histamine.

Acetyl-beta-methylcholine or mecholyl has also been used extensively by this method, but the majority of observers have found it less satisfactory as it requires a higher concentration of solution, longer period of application, larger concentration of the current, and the systemic reactions are more frequent and alarming. Its most recent application is an ointment of analgesic balm applied to the part together with infra-red radiation reported by Cohen and Rosen.⁶

The term "ionization" is applied to the dissociation of a salt into its ions. The electric current does not accomplish this; it merely demonstrates the dissociation. The movement exhibited by a charged colloid in an electric field is termed electrophoretic or cataphoretic mobility.

Electro-osmosis should be the term of choice when a substance is carried passively with the electro-osmotic flow of liquid, e.g., alcohol or a procaine base. Iontophoresis is the term used when the therapeutic mechanism is believed due to independent ionic migration. Abramson and Alley⁷ have reported and clarified the mechanism of histamine iontophoresis from an aqueous medium. It is

not the purpose of this paper to discuss the advantages and disadvantages of methods nor the technical aspects of electro-kinetic phenomena. Therefore, with the preceding brief comments on technic and fundamentals the rationale of this particular type of therapy is a question worthy of consideration.

Indications

Histamine iontophoresis has found its largest application in rheumatic conditions. Abnormal peripheral circulation, consisting of cyanotic, cold, clammy hands and feet, is frequent and common in most types and stages of these states. Vasoconstriction producing ischemia is responsible for painful contractions characterizing various forms of muscular rheumatism as torticollis, lumbago, myalgia of the shoulder and ilio-tibial bands. Circulatory disturbances such as vasospasm or inflammation are important factors in the production of soft tissue changes in arthritis, periarticular swelling, contracture and atrophy of tendons and muscles, induration of joint capsules and trophic skin changes.

Whether bony changes occur as a result of abnormal circulation in the joints or not is controversial. However, it is significant that changes occur in the ends of the long bones and that overgrowth of the patella in dogs has been produced by ligating soft tissues. Abnormalities in blood flow, carbon dioxide content and capillaries of arthritic patients have also been demonstrated.

Many workers have, however, noted the absence of arthritic changes in extremities amputated for diabetic or arteriosclerotic gangrene, thus casting doubt on the primary importance of circulatory disturbances. As a rule muscle conditions are present, however, before any joint or bony changes are apparent. Regardless of whether circulatory changes are primary or secondary etiologic factors of arthritis, correction of the disturbances of the peripheral circulation is one of the main objectives of the therapy of rheumatic disease. It is on this principle that the use of histamine has found its basis.

Many series of cases have been reported, however Kling and others have probably accumulated the largest series yet reported. In 1933, he reported 730 cases of rheumatic affections with 83.5 per cent cured or improved, 16.5 per cent not benefited, and temporary relief in 24.8 per cent. In 1935, he published an account of 150 cases with cure or improvement in 74.6 per cent. The above series of cases included vasospastic conditions, Buerger's disease, myositis, subacromial bursitis, tenosynovitis, brachial neuralgia, post-traumatic arthritis, rheumatoid arthritis, gout, gonococcal arthritis, osteo-arthritis, sacroiliac arthritis, spondylarthritis and radiculitis. Of the various joint conditions best results were obtained in post-traumatic and least in sacroiliac arthritis. Soft tissue affections as myositis, subacromial bursitis, tenosynovitis and brachial neuralgia showed cure or improvement in over 90 per cent of acute cases. In rheumatoid arthritis, no effect was noted on articular effusions. Kling concluded that therapy in arthritis is more effective on the smaller than the larger joints.

Because of the prevalence of rheumatoid disease in this part of the country and, more especially, the large number of cases being treated at the University Hospital, it seemed advisable to undertake this therapy in the light of the encouraging results published. The cases selected for this study were from the Medical Out-Patient Department with their permission and cooperation.

Technic

Treatments were given according to the severity of the case, daily, or three times weekly. A 1:3000 solution of histamine dihydrochloride was applied to the affected part or parts on filter paper; sheet wadding soaked in normal saline was then applied over this, then a metal strip electrode held in place by a rubber Davol bandage was put on. As the indifferent electrode a padded metal plate was used, a standard time of five minutes was used and the current intensity varied

according to the size of the area and patient's tolerance. In most cases a series of twelve treatments was given as a trial. A control series of ten cases was run using normal saline solution on both poles, and a series of ten cases using histamine on the active pole with no current. On the former control series a reflex vasodilation occurred which rapidly disappeared with no flare or wheal formation. On the latter there was no reaction. In both series no therapeutic effect was observed. All cases treated were ambulatory.

The patients selected for treatment had received other types of therapy including vaccine, diathermy, bee-venom, chaulmoogra oil, supports, and fever therapy. It was felt that an adequate test was to take cases which had not responded to these types of therapy. Results were evaluated according to the symptomatic relief. It would be presumptuous to assume, in arthritic patients, that a cure was obtained without adequate follow-ups.

In the series of forty cases, thirty-one had arthritis of various types and manifestations, two had brachial neuralgia, one back strain, three back sprain, one Buerger's disease, and two suffered from myalgia.

The study covered a period from August 1, 1939 to February, 1940.

The accompanying tables (1-3) list the results. Follow-ups have been obtained on most of these cases; however, it is obvious that over such a short period it is difficult to evaluate results in arthritis, which are characterized by spontaneous remissions and exacerbations, and wishful thinking on the part of chronically affected patients. However, results in this series compare favorably with those of other workers; therefore, it may be assumed that they are reasonably accurate. It is of interest to note the average duration of symptoms, also that the patients who received no relief had a duration of three years or more and had received inadequate relief from other types of therapy.

Also of interest was a seventy-six-year-old white male who suffered from low back pain with stiffness for twenty years and received complete relief from the first treatment. This patient's x-ray showed arthritis of the sacroiliac joints and the lower lumbar spine. For the past two years he had been unable to bend over and tie his shoe laces, together with difficulty in starting the urinary stream, and frequency. He was given a series of twelve treatments with relief of all symptoms. He was discharged and six weeks later contracted an upper respiratory infection with an exacerbation of the old symptoms. He returned for another series of treatments and again was relieved. To date he has had no recurrence.

Where other types of therapy were indicated, they were instituted, e.g., arch and/or back supports, after the course of treatments.

As other observers have noted in joint involvement, the more readily accessible joints, especially fingers, feet, back and wrists responded better to treatment. Knees and shoulders show the least favorable results. Joints showing bony destruction in x-rays also do not respond favorably. Martin and Eaton⁸ using mecholyl, reported no beneficial effects on three cases of spondylarthritis of the Marie-Strümpell type.

An important feature of histamine iontophoresis is that if the patient is to receive any relief, it is usually noted that the first one to three treatments will give partial or complete relief. To test this feature those patients who received no relief were given a standard series of treatments and a few as many as twenty-four with no amelioration.

Histamine will not prevent exacerbations in other locations. Toxic reactions are few; in nearly 500 treatments only one case had an immediate or allergic reaction. This consisted of generalized flushing, rapid respirations, dilated pupils, dizziness, and fall in blood pressure, which was immediately controlled by a subcutaneous injection of adrenalin. One other patient experienced some diffi-

TABLE 1. — *Relief Obtained and Treatment Employed in 40 Cases.*

	Cases	Per cent
Relief —		
Complete	23	57.5
Partial	12	30
None	5	12.5
Symptoms present less than 2 years*.....	16	
Relief obtained	16	100
Symptoms present 2 years or more*.....	24	
Relief obtained	19	79.1
Treatment —		
Vaccine	30	
Other treatment	33	
Histamine only	7	

* Duration of symptoms in these cases was from 1 day to 18 years; average, 4.43 years.

TABLE 2. — *Relief Obtained With Histamine.*

Condition	Total Cases	Number Relieved
Arthritis	31*	26
Brachial neuralgia	2	2
Back strain	1	1
Back sprain	3	3
Buerger's disease	1	1 (partial relief)
Myalgia	2	2

* One old gonococcal infection.

TABLE 3. — *No Relief Obtained in Arthritis With Histamine (5 Cases).*

Duration of Symptoms, Yrs.	Involvement	Previous Treatment
3	Cervical	Roentgen ray, vaccine, bee venom, histamine, injection
3	Generalized	Vaccine, diathermy
7	Knees	Diathermy, vaccine, chaulmoogra oil
11	Sacro-iliac	Vaccine, diathermy
6	Shoulders	Vaccine, bee venom, diathermy

culty in breathing four hours after treatment. This was obviated by giving the patient a $\frac{3}{8}$ grain capsule of ephedrine sulfate at the end of the treatment.

Boyd, Osborne, and Markson,⁹ using mecholyl reported that most of their cases (thirty-five) had a sense of heaviness on the chest and inspired deeper; also flushed face, neck and ears and marked perspiration were noted. In the average treatment these symptoms do not appear after using histamine; however, one should be prepared to meet them.

In view of this series and those of others, it may be said that histamine iontophoresis offers a simple, harmless adjunct to the therapy of arthritis and shows a high degree of symptomatic relief in this and other conditions manifesting peripheral vascular abnormalities. It is an economical method from the patient's standpoint and does not require expensive equipment. The source of the galvanic current may be obtained from batteries or a household current. Treatments may be carried out in the home.

Summary

1. Forty cases treated by histamine iontophoresis are reported with great symptomatic relief.
2. The method is simple and harmless if properly carried out.

3. Histamine iontophoresis is not held as a "cure" but a valuable adjunct to the therapy of arthritis.
4. It definitely will benefit certain types of specified muscle conditions as gout, myalgias, strain, and sprain.
5. It has a definite place in treatment of peripheral vascular disorders as acroparesthesia and Raynaud's disease.
6. Introduction of drugs into body tissues by this method has a wide application and opens new fields of therapy.
7. It does not require expensive equipment and is economical to the patient.

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Discussions

Dr. Jerome Weiss (Brooklyn): Arthritis is dreaded because it frequently takes its devastating toll of rich and poor, young and old. A contribution to the control of this scourge is always welcome, but it is important not to permit enthusiasm to exceed the bounds of accuracy, and this the essayists have done. The listing of cases treated and the results obtained are conservative and convincing. Their suggestions as to a fixed terminology are timely and commendable.

Doubtless many more practitioners who treat arthritis would use histamine iontophoresis if the ease and simplicity of the technic were generally understood. The essayists, however, consider the matter of apparatus rather lightly, when actually it is an important feature. A good galvanic equipment should be ground-free and provide smooth current and dosage control. It must also be polarized, either by fixed output posts or by the swing of the meter needle or pole changer switch. Few low-cost galvanic outfits for home use have all of these essential features.

Attention must also be called to the matter of the indifferent or negative electrode. It is under the negative electrode that galvanic burns are most apt to occur. The best assurance of safety is to use a hand or foot immersed in water or a weak saline solution suitably contacted to the negative pole. The essayists do not mention the newer technic with a histamine-bearing ointment to replace the filter pa-

per and solution, but this omission is probably for the sake of brevity.

Dr. Reiley and Dr. Knapp have presented a most acceptable analysis of the use of histamine iontophoresis in the treatment of arthritis, and their work should prove an inspiration to all who would treat this obstinate disease.

Dr. Walter M. Solomon (Cleveland): The treatment of arthritis and the various rheumatic disorders has long been considered discouraging and disappointing by many and perhaps not without a certain justification. There is no group of patients who are subjected to more ill tasting drugs, to more frequent and varied types of injections, and to more weird forms of therapy than the unfortunates suffering from arthritis, and who for all their patience and tolerance too often receive but little or no benefit. It is therefore encouraging to have the essayists again call to our attention the advantages of histamine iontophoresis and note the high percentage of relief secured. Electrophoresis tends to alleviate one of the pathologic conditions seen in the various arthritic disorders; namely, peripheral vasoconstriction. That the functioning capillaries in chronic atrophic arthritis, the most distressing form of the arthritides, are markedly reduced in number has been demonstrated repeatedly, so that the introduction of any drug which will increase the blood flow to the periphery should be of definite advantage. And in

the other rheumatic diseases, circulatory changes in some form have been considered a possible etiologic factor, so that any therapy which will tend to correct such conditions, should bring about symptomatic relief.

During the past few years there has been considerable discussion as to the relative merits of histamine and mecholyl electrophoresis for arthritis. Kling has used histamine in a large enough series of cases and for a long enough period of time to establish its value. The results reported by the essayists and other investigators who have used histamine, confirm the effectiveness of this drug. Other groups have used mecholyl with equally good results. The reports from Kovács, Boyd, Martin and his group compare favorably with the work from the clinics using histamine. It is difficult to draw conclusions as to the advantages of either drug from the reports thus far published. Perhaps a fair estimation could be reached by the use of both drugs in the same clinic on alternate patients over a sufficient period.

The argument that histamine acts primarily upon the capillaries and mecholyl upon the arterioles seems unconvincing since both secure the same end effect, that of vasodilatation and a subsequent active hyperemia. The objections to mecholyl because its administration by electrophoresis requires a greater concentration of the solution or that the treatment requires twenty instead of five minutes' time, and a higher amperage than histamine are not important. Systemic reactions such as flushing, marked perspiration, increased salivation do occur with the use of mecholyl, but in my experience at City Hospital, they have not been alarming. This generalized parasympathetic stimulation may even be of distinct value in the treatment of chronic atrophic arthritis, which of course, remains to be proved.

The essayists' grouping of the 31 cases as arthritis may have been necessary due to lack of time for delivery of the paper. However, to gauge more adequately the worth of the therapy one would like to know into which specific type of arthritis these patients would be classified. And

though the number of years of symptoms is important, it is more valuable to know the condition of the joints, that is, whether there was evidence of acute or subacute infection, deformity, whether the patient was ambulatory or not, and also data obtained from the sedimentation test and Schilling count with regard to the activity of the arthritic process.

The effectiveness of this type of therapy for the relief of subjective symptoms is certainly undeniable. However, its usefulness and applicability should be properly evaluated. It has certain limitations, chief of which is that it requires apparatus whose operation could not be entrusted to the average lay person. Reactions might occur which require immediate attention. All of these factors more or less preclude this type of treatment in the home, a factor which often must be considered. Furthermore, in order to be of unusual value it must be markedly better than the less complicated and expensive methods which are now available for local application to affected joints, such as infra-red lamps, paraffin, water, and the like. It may justly serve as an adjunct to the other forms of physical therapy or as brought out by Doctors Reiley and Knapp, it may be used in cases refractory to the simpler forms of treatment. It is also important to stress that electrophoresis is not a panacea for arthritis any more than the other physical modalities, and that if used to the exclusion of other important medical measures, it will certainly end in failure.

Dr. Miland E. Knapp (closing): I wish to thank the discussors. As a matter of fact, I was very much surprised when I saw my name was on that paper. Dr. Reiley really did all the work himself and I think it was just a courtesy to put my name on it.

I can say this much, in answer to the questions, that all of these cases were cast-offs from the Medical Clinic, cases they had given up on. The idea was just to see what would happen with histamine by iontophoresis, so all of them had been worked on, and all of them had laboratory work, although it was not reported in this paper.



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∴ EDITORIALS ∴

THE PSYCHOLOGIC ELEMENT IN PHYSICAL THERAPY

The art and science of medicine have become so complicated and extensive in scope that no one man, no matter how gifted and industrious he may be, can possibly master it in its entirety. This fact as much as the aim to insure a greater degree of perfection among physicians or surgeons has necessitated specialization. The list of medical and surgical specialties and subspecialties is large and slowly but surely growing.

Although specialization is to be recognized as a desideratum, it is not wholly devoid of certain undesirable features. A man deeply interested in astronomy who intently gazes at the stars while walking is apt to stumble into a pit. It is much the same with the specialist who can see nothing else than his more or less restricted field. He loses contact with the fundamental principles of the healing art and is in danger of losing his way.

The ideal specialist is he who concentrates virtually all of his energies to his particular field of endeavor but at the same time does not lose sight of correlated problems. And in weighing such problems from his point of view he must guard against the pitfall of becoming one-sided.

An illustrative example of forcing general problems into one's own particular system is seen in a contribution by a distinguished Scotch psychiatrist published elsewhere in this issue.¹ While this article contains valuable data which physicians particularly interested in physical therapy can profitably apply in their daily work, there are also implications which must be carefully analyzed and applied only after careful consideration of a number of factors.

Any implication that therapeutic effects of certain physical agents are psychologic in nature is neither sound in principle nor demonstrable by indisputable evidence. This is of especial importance in our discipline because the author in question is not the first one to have subtly thrown out a hint about psychologic rather than physiologic effects of physical therapy. It is not to be denied that any material help given a sufferer by a physician includes a certain psychologic influence. The very personality of a physician is a factor in inspiring confidence, and this in turn proves of distinct help to the patient. The Romans have expressed this in the adage that the physician's beard wins half the battle, and we have but to translate this in terms of appearance, tact and the environment of a practitioner of medicine to render the adage applicable to modern times.

On the other hand neither the personality of a physician or surgeon nor the best equipped office or hospital will prevail if one should rely solely on psychologic effects. Histopathologic, or if one prefer, pathophysiologic states are too concrete (organic) in nature to be affected by psychic influences. Callus formation, to cite an example, cannot be stimulated by suggestion, no more than the inflammatory process in acute arthritis, albeit it must be admitted that the pain often is greatly lessened in degree by psychologic measures. Physical agents are no longer unknown so far as their physiologic effects are concerned, and as a corollary the choice of an agent and its technique of administration even with regard to dosage does not in the least differ

from pharmacotherapy or surgical procedures. Were it otherwise, physical therapy would indeed be in a sorry state of development.

Again, it is frequently pointed out that certain neuroses that have been improved or cured by physical therapy actually have been improved or cured by purely psychic effects. This is explained by the patients' awe while facing "mysterious" machinery, listening to the hum of a converter or observing sparks produced by electric currents, and the like. Here the psychiatrist takes more credit for his specialty than can be conceded. A noted French physician has made the statement that an individual suffering from an imaginary disease actually is a sick individual. If this be accepted as true, how much more forcefully does such a dictum apply to conditions we are only too prone to group as neuroses. We know, of course, that mental trauma produces pathophysiologic effects of a fleeting nature, but it is questionable to say the least, whether a so-called hysterical joint is due to psychogenic and not to organic factors. This and similar problems clearly show that after all is said and done, the prime and most important duty of any physician is to establish a correct diagnosis in the fullest meaning of that word. The old saying that he who diagnoses well will treat well, has not lost one iota of its clinical importance. A correct diagnosis implies the etiologic determination of material as contrasted with psychic factors, so that one thereby is enabled to prescribe either physical or psychologic measures, or both. That and that only is the proper way to practice any branch of scientific medicine.

Reference

1. Halliday, James L.: Psychologic Implications of Physical Therapy, Arch. Phys. Therapy **22**:261 (May) 1941.

MEETING AND SEMINAR OF THE SOUTHEASTERN SECTION

This, the youngest but virile branch of our Congress, will for the first time in its history hold a three-day scientific session and seminar May 25 to 27, inclusive, at the Hotel Patten, in Chattanooga, Tennessee. The selection of this city is a particularly happy one, for apart from its comparatively easy accessibility even to physicians living in the North, it offers in its immediate vicinity historical places hallowed by the Civil War and regarded by all patriotic Americans as national shrines.

The Seminar which is open to qualified technicians as well as ethical physicians, will occupy the entire afternoon of Sunday, May 25. Four important problems of every-day clinical work will be thoroughly discussed by specialists of national reputation.

The following two full days will be devoted to the presentation and discussion of no less than nineteen papers by authorities who require no introduction to physicians interested in physical medicine. The subjects cover a wide range of scientific and clinical considerations. The full program will be found in the advertising section of this issue to which the reader is referred.

A nominal fee of three dollars is charged members and guests which covers attendance of the seminar, the meetings, the exhibits and the banquet-dinner which will take place Monday evening.

Many exhibits will bring to the meeting the latest improvements in technical equipment. Last but not least, this convention will greatly aid in developing a cordial *esprit de corps* and advancing the interests of physical therapy in the southern regions of our land.

All who can possibly do so and desire to profit from this event should communicate with the branch secretary, Dr. Kenneth Phillips, 1150 S. W. 22nd Street, Miami, Florida.

WESTERN SECTION MEETING

The Western Section of the American Congress of Physical Therapy will hold its ninth annual session on June 22 next, in Los Angeles. Adequate facilities for a large attendance are provided by the White Memorial Hospital, whose directors have placed their spacious Taulson Hall at the disposal of the section.

It has been decided to make this session one that will attract all physicians at or near the Pacific littoral who are seriously interested in the clinical problems of physical therapy. The entire day will be divided between a seminar to be conducted during the forenoon, and the presentation of papers and discussions during the rest of the day. There will be neither exhibits nor a banquet. The usual luncheon hour will be devoted to a round-table discussion of an informal nature.

The past meetings of the Western Section have always been as interesting as they were fruitful, as those who participated and readers of the *ARCHIVES* will recall. There is not the least reason to doubt that this coming session will equal if not exceed the preceding conventions, which were held in a most fascinating environment on the Pacific coast. Apart from the fact that Drs. John S. Hibben, as Chairman, and Frances Baker, as Secretary, have devoted much time and energy, success is assured by the whole-hearted cooperation of Dr. Clarence W. Dail, Assistant Professor of Pharmacology and Therapy, College of Medical Evangelists, Loma Linda, California, who has taken active charge of the conference. The speakers for the program have been carefully selected from men best qualified to afford ethical practitioners and physical therapy technicians valuable instruction of a practical character.

The morning program has been placed in charge of Dr. William Worster, who has made a serious effort to exploit the available time in a manner to make it as instructive and profitable as possible. The afternoon session will be conducted by Dr. Clinton D. Hubbard, a guarantee that the reading and discussion of papers will be carried out without waste of time.

There will be no charge whatever to members and visitors, and a hearty invitation is extended to the regular medical profession and to qualified technicians not only to attend the Seminar and the Scientific program but to take an active share in the deliberations.

CRYMOTHERAPY

Medicine owes its progress in part to the curiosity that constantly stimulates the search for new weapons with which to combat well known diseases or their newer pathologic variations. Among the methods which challenge scientific inquiry is the use of general and local refrigeration and its effects on tumor formations and the relief from pain. An experiment recently conducted in Lenox Hill Hospital, New York, was inspired by the "artificial hibernation treatment" originated by Temple Fay and his associates of Temple University Medical School. The Philadelphia investigators applied the technic to cancer patients in whom unconsciousness or semiconsciousness had been artificially induced in order to assuage pain. Fay and Smith had been able to refrigerate patients from 10 to 18 degrees below normal for periods varying from a few hours to as many as five days.

In the Lenox Hill Hospital experiment, a room with a capacity of two beds was constructed, specially equipped, thermostatically controlled and, by air conditioning, maintained at a temperature of 55 F. The crymotherapeutic experiment lasted four months and was performed on twenty-seven patients. Proper instructions were given in advance to the intern and nursing personnel in the clinical and technical details to be employed. Precautions were taken to protect the nurses against undue or prolonged exposure to cold. Facilities for prompt telephonic communication with resident physicians were available. Selection of the patients was based on their fair general condition, if able to be up and about, or, if bedridden, on the presence of intractable pain, or large measurable tumor masses. Most of the patients (twenty-two) presented different forms of grave carcinoma, such as carcinoma of the prostate, bladder, heart, cervix, thyroid and colon.

In the procedure followed the patient received chloral and bromides the night before and phenobarbital in the morning. A Levine or Einhorn tube was passed into the stomach and the patient rendered unconscious by rectal and intravenous injections of two generally known anesthetics. He was then brought into the room and placed naked on a bed. The thermocouple was inserted into the rectum, a rubber-covered wire cable leading from the patient's rectum to the recording dial on the wall. The wrists and ankles were tethered with padded restraining loops. The patient's trunk, from the shoulders to half way down the thighs, was then packed with loose ice of the size of nut coal. This ice pack was maintained until the rectal temperature reached 90 F. (a process requiring usually from one and one-half to two and one-half hours). It was then removed and the patient dried. At a room temperature of 55 F. the patient's rectal temperature would go down to 80 F. Normal temperatures were kept between 80 and 85 F. If the temperature became too low, blankets and luke-warm water bags were used. If the temperature rose, ice bags without cloth coverings were applied to the trunk and upper thighs. The temperature, pulse, respiration and blood pressure were charted every half hour. Through a stomach tube a dose of 8 ounces (60 cc.) of physiologic solution of sodium chloride with a 10 per cent dextrose solution was instilled every hour. For restlessness, sodium amytal or soluble phenobarbital was usually given in suitable quantities. Twice a day the stomach was siphoned empty. Once a day the stomach was lavaged with a quart (liter) of physiologic solution of sodium chloride, a pint at a time. When treatment was to be discontinued, the air conditioning apparatus was shut off and the room allowed to return to normal temperature. The patient was covered with blankets and the body slowly restored to the normal temperature. This required from six to eight hours. Not until then was the patient returned to the ward. Inductions could be repeated five times or more, depending on the patient's general condition.

The authors report that in eleven of seventeen cases of intractable pain due to carcinoma there was sufficient alleviation of pain to obviate the necessity of administering narcotics for variable periods. In one case of prostatic carcinoma the patient had been unable to lie on his back for more than a few minutes at a time. After the first session in cryotherapy he was able to do so without large doses of morphine and cobra venom. In some cases there was little or no relief from pain. Eventually pain recurred in all cases, in some as early as twenty-four hours after treatment was discontinued. Once relief lasted as long as eight weeks. Recurrence of pain and progress of cachexia may be due to the fact that the intervals between treatments were too long. Regression of primary tumors or metastases was not observed, nor could unusual cell alterations on neoplastic tissue be demonstrated. Roentgenoscopy of bone metastases in two cases showed a definite increase. The presence of pulmonary metastases seemed to predispose to pulmonary complications, though otherwise risks from pneumonia and nephritis were not as great as expected. Neurologic observations after the treatment did not differ from the neurologic status before. Thirteen of the twenty-seven patients died subsequently, within six to forty-six days after their last induction, from a variety of causes.

The authors suggest the extension of cryotherapeutic experimentation to other diseases, such as Hodgkin's disease, venereal lymphogranuloma and subacute bacterial endocarditis. A patient with non-carcinomatous drug addiction, who had taken from 6 to 8 grains (0.4 to 0.5 Gm.) of morphine daily for at least fifteen years, after five days of the treatment lost her craving for the narcotic and experienced her first normal menstruation in seven years. Local cryotherapy was performed in too limited a degree to warrant conclusions as to its merits. Vaughn, in a recent report on cryotherapy applied to six patients with hopeless metastatic carcinoma, found that relief of pain was "the only result of possible value" achieved. He regards the procedure as hazardous and not justifiable in the treatment of advanced metastatic carcinoma.

In general, these results seem to promise little or nothing for this method as a general treatment for carcinoma. Nevertheless the therapeutic uses of cold may be considerable. Such biologic investigations as have been recorded have added greatly to scientific knowledge of the effects of cold on living tissue. — Editorial, *J. A. M. A.* 114:2390 (June 15) 1940.



SCIENCE, NEWS, COMMENTS

New York Physical Therapy Society

The New York Physical Therapy Society will hold its joint session with the Section of Historical and Cultural Medicine of the Academy of Medicine, Wednesday evening, May 14, 1941, at 8:30 p. m., 2 East 103rd Street, New York, N. Y. The scientific program, to which all physicians are welcome, will be as follows:

1. History of Fever Therapy, *William Bierman, M.D.*

Discussion opened by *Bernhard Dattner, M.D.* (by invitation).

2. History of Electrodagnosis, *Sidney Licht, M.D.*

Discussion opened by *Saul L. Heller, M.D.* (by invitation).

Dr. Hibben a Grandfather

The mail once again apprised your commentator that our section on the Pacific littoral will hold its annual session in Los Angeles, on June 22, at the White Memorial Hospital. Prominent is the role to be played by the youngest and self-effacing grandfather, J. Severy Hibben, who like unto years in recent memory was leader of the four horsemen (Worster, Moor, Dail and Hibben) that always attained their successful objective by the very balance of brain and brawn. Who was it who said that time passeth understanding and is the lever of all things? Only but yesterday in the memory of most of us is the picture of Severy the adolescent, the youth and man, the dignified President of a national society standing on the illuminated podium delivering his thought arresting oration — oracular in tone and vigorous in stance. Today we realize the meaning how changing is time. For mark you, in its swift passage, time has placed its benediction not unlike a snowy white mantle over the once square shoulders of this vimsical and vigorous man by according him a distinction new and rare. John Severy Hibben has become a granddaddy! A happy moment to him, and the beginning of a new and fascinating drama of watching the seed mature and develop from dreams into reality.

And so while we felicitate our new grandpappy and wish him and his grandson all the goodness of the earth, we wonder whether Severy has reached the years of discretion and is entering that mysterious state of senescence where dreams are actualities and actualities are dreams. It certainly must be a source of extreme satisfaction to know that his numerous friends have given him many incidences to store in memory and that their affection will be a stout crutch for him to lean upon. And if wishes come true, is it not within the scope of imagination to envision a junior

Severy treading the same podium in years to come, a doctor whose fame will be all the greater for the reputation that preceded him? The apple falls not far from the tree, and as the saying goes, a good tree has many apples. Here's wishin'.

Free Manual on Nursing Care of Infantile Paralysis

The National Foundation for Infantile Paralysis announces the publication of a Spanish translation of the pamphlet, "The Nursing Care of Patients with Infantile Paralysis," by Jessie L. Stevenson, R. N., Consultant in Orthopedic Nursing, National Organization for Public Health Nursing. This pamphlet, illustrated by line drawings, was prepared by the National Organization for Public Health Nursing for The National Foundation for Infantile Paralysis as a part of a project in orthopedic nursing sponsored by the Foundation. It is intended to assist the public health nurse and others responsible for home care of patients with infantile paralysis in and following an epidemic. Copies either in Spanish or English are available free upon request from The National Foundation for Infantile Paralysis, 120 Broadway, New York City.

BASIL O'CONNOR, President.

Graduate Program in Physical Therapy at Stanford University Medical School

The Stanford University Medical School is to be highly commended and the American Physiotherapy Association congratulated for sponsoring a special graduate course in physical therapy. Special arrangements have been made between the two organizations for special graduate study in physical therapy during June 23 to July 18, 1941, a period which no doubt will be a fruitful investment for all concerned. The only fly in this scholastic program is the lamentable fact that physicians and their national organization, the American Congress of Physical Therapy, were not included as an advisory body in a program which should be supervised by those within this especial field of organized medicine. It is a challenge to logic and common sense that a certain phase of the practice of medicine developed, fostered and applied by physicians and allied science for therapeutic purposes, should be taken over in the present instance by an ancillary body — the technical aides — with the approval of a great medical University and the benediction of certain physicians of talent and vision.

In certain respects such a situation cannot but be deplored. While we sincerely congratulate the initiative of the American Physiotherapy Association and their progressive spirit for service and

knowledge, by contrast their splendid program, forces the question upon us whether we have not been remiss in our effort and obligation to equal or, nay, better the program of instruction on physical medicine for the guidance and inspiration of all those interested and working in our discipline. We publish their program in full because it is a challenge to our best and perhaps to our inadvertent complacency. Ours must be even super-best. And that this is actually attainable, it is no secret that behind the scene of this program of the American Physiotherapy Association is to be found the guiding intellect of some of our own members and our prominent teachers of physical therapy.

Program of Instruction

Special arrangements have been made with Stanford University for graduate work in Physical Therapy during this period of four weeks. The first three weeks of classes will be held at the Medical School in San Francisco, the final week on the Palo Alto campus at Lagunita Court.

Schedule of Classes (from the *Stanford University Summer School Bulletin*).

3:30-5:00 P.M.

W253. Advanced Kinesiology. The study of kinesiology in relation to certain corrective physical education and physical therapy procedures. 2 to 5 units (Worthingham).

5:00-6:00 P.M.

W267. Psychology of the Invalid and the Handicapped. A study of the reactions to illness and affliction, consisting of (a) a review of the general principles of psychology as related to personality development; (b) the role of organic and psychological factors in determining the reactions of the individual; (c) comparison of normal behavior with neurotic and psychotic patterns; (d) Is there a special psychology of the invalid? (e) special case histories and demonstrations. 2 units (Chor).

6:00-7:00 P.M.

W258. Therapeutic Gymnastics. An analysis of the purposes, techniques, and possible results to be obtained from the use of therapeutic gymnastics. 2 to 5 units (Worthingham).

7:00-8:30 P.M.

W266. Skeletal Muscle and Motor Activity in Health and Disease. A summary of the normal and anatomical, physiological and chemical characteristics of muscle. Particular emphasis will be placed on therapy in muscle disorders. 3 units (Chor).

By Arrangement

W263. Study of a Special Problem in Physical Therapy. 2 to 5 units (Worthingham).

Kinesiology continues at Lagunita Court under the heading of Muscle Testing. The other courses continue under the same titles.

Application for Admission. Students registering (for credit) for the first time at Stanford University must file an application for admission. State

whether you wish the undergraduate or graduate application blank. Address letters of inquiry to Division of Physical Therapy, School of Health (Women), Stanford University. This application should be made, if possible, a month before registration day. The fee for the application is \$5.00.

Registration. Credit cannot be obtained for more than six units during this period of four weeks. The minimum registration fee for the short term is \$48.00 (6 units). A syllabus fee of \$1.00 per course is added to the registration fee. Any combination of courses may be worked out using the units under individual study to complete the 6 units when necessary. The regular summer session is 8 or 10 weeks, depending upon the courses selected. It is possible to take a full quarter's work during the summer session, if you are interested.

Auditors. \$25.00 is the auditor fee for 5 units. No permanent university records are kept for auditors.

Registration Day. Registration will take place June 23 at the Medical School in San Francisco, beginning at 2:00 P.M.

Living Accommodations. A committee of the Northern California Chapter is making a list of available accommodations near the Medical School. We suggest you write directly to Miss Grace Benson, University of California Hospital, San Francisco, for this information.

SCHEDULE OF CONFERENCES

The dates are July 13 (Sunday) to July 18 (Friday). The place is Lagunita Court, Stanford University, Palo Alto. The cost of accommodations, room and meals, for five days (beginning with dinner Sunday night and ending with luncheon Friday noon) is \$20.75 for members and \$21.75 for non-members. This includes registration fee.

Sunday, July 13

- 3:00 P.M. Registration.
- 5:00 P.M. Get-acquainted Supper.
- 7:30 P.M. Business Meeting.

Daily, Monday Through Thursday, July 14-17

- Discussion Groups.**
- 8:00 A.M. Muscle Testing.**
Chairman, *Alice Lou Plastridge*, of Warm Springs, Georgia.
Consultants—*Charles H. Danforth*, Ph.D., Stanford University; *Verne T. Iman*, Ph.D., M.D., University of California.
- 9:30 A.M. Therapeutic Gymnastics.**
Chairman, *Catherine Worthingham*, of Stanford University.
Consultant—*Charles L. Lozman*, M.D., Orthopaedic Hospital School, Los Angeles.
- 11:00 A.M. Psychology of the Invalid and the Handicapped.**
Herman Chor, M.D., Associate, Department of Nervous and Mental Diseases, Northwestern University.

12:15 P.M. Luncheon.**1:30 P.M. Selection and Evaluation of Equipment in Heat Therapy.**

Chairman, *Hazel Furscott*, San Francisco.

Consultant — *Frances Baker*, M.D., University of California.

3:00 P.M. Skeletal Muscle and Motor Activity in Health and Disease.

Herman Chor, M.D.

4:30 P.M. (Monday and Wednesday) Problems of Crippled Children's Schools.

Chairman, *Emily Adams*, Oakman School, Detroit.

Problems of Physical Therapy Schools.

Chairman, *Susan G. Roen*, Orthopaedic Hospital, Los Angeles.

(Additional discussion leaders for each of the above topics will be announced soon.)

Friday, July 18**8:30 A.M. Recent Studies in the Treatment of Anterior Poliomyelitis.**

Chairman, *Sara Kollman*, University Hospital, Minneapolis, Minnesota.

10:00 A.M. to 12:00 M. Business Meeting.

Sport clothes are in order. You will not need formal clothes.

Do make your reservations early. If you wish to be in the same building as your friends, indicate their names on your reservation blanks.

CONFERENCE OF PHYSICAL THERAPISTS AT TRI-STATE HOSPITAL ASSEMBLY

If the past experience of attendance at the Tri-State Hospital Assembly runs true to form, and evidences at hand already promise this to exceed past sessions, this conference will be one of the largest in its history. These impressive as well as constructive meetings redound to the credit of the executive genius of Dr. MacEachern, and his ability to cement heterogeneous groups into a harmonious whole is the index for its helpful effect on the progress of hospital and allied management in relation to contemporary medicine. Three days will be devoted to problems of physical therapy and are sponsored by sections of mid-western States of the American Physiotherapy Association. The session will be held at the Stevens Hotel, Chicago, on May 7-9 beginning the afternoons of each of the three days.

Wednesday, May 7 — 2:15-4:15 P.M.

Hattie A. Miller, Milwaukee; Department of Physical Therapy, The Milwaukee Curative Workshop, Presiding.

Introduction

Herle L. Fritschel, D.D., Milwaukee; President Wisconsin Hospital Association; Director, Milwaukee Hospital "The Passavant".

Greetings from the Tri-State Hospital Assembly**Relation of Physical Therapy to Radiology**

S. A. Morton, M.D., Milwaukee; Radiologist and Director of Physical Therapy, Columbia Hospital.

A Curative Workshop Program with Movies

Marjorie Taylor, Milwaukee; Vice President, American Occupational Therapy Association; Director, The Milwaukee Curative Workshop.

Burns

Harold M. Trusler, M.D., Indianapolis; Chief Plastic Surgeon, Indiana University Medical Center — Joint Session of Physical and Occupational Therapists.

General Discussion**4:15-4:45 P.M.**

Business Session — Physical Therapists Section of the Tri-State Hospital Assembly.

Election of chairman, secretary and program committee for ensuing year. Other business.

4:45-6:00 P.M.

Inspection and Study of Technical and Educational Exhibits — Exhibition Hall.

7:30-10:00 P.M.

Departmental Panel Round Table Conference for All Groups and Sections of the Tri-State Hospital Assembly. Physical therapy problems will be discussed.

Thursday, May 8**2:15-4:15 P.M.**

Esther Stumbo, Chicago; Chief Physical Therapist, Cook County Hospital, Presiding.

Physical Therapy in Army Hospitals

John S. Coulter, M.D., Chicago; Associate Professor and in Charge of Department of Physical Therapy, Northwestern University School of Medicine.

The Treatment of Pelvic Inflammations with the Newman Thermo-Flo

Jerome D. Kaufman, M.D., Chicago; Associate, Department of Gynecology, Cook County Hospital.

Therapeutic Exercises

Charles O. Molander, M.D., Chicago; Member of Attending Staff and Director of Physical Therapy, Michael Reese Hospital.

General Discussion**4:15-6:00 P.M.**

Inspection and Study of Technical and Educational Exhibits — Exhibition Hall.

7:00 P.M.

Tri-State Hospital Assembly Banquet.

A most cordial invitation to the Banquet is extended to all Physical Therapists attending the meeting.

Friday, May 9

2:15-4:15 P.M.

Hattie A. Miller, Milwaukee; Department of Physical Therapy, The Milwaukee Curative Workshop, Presiding.

Flora A. Mitts, Grand Rapids; Chief Physiotherapist, Blodgett Memorial Hospital, Co-Chairman.

Treatment of Fractures of Hip (Illustrated)

John T. Hodgen, M.D., Grand Rapids; Chief, Bone and Joint Surgery, Blodgett Memorial Hospital; Consultant and Chief Orthopedist, Mary Free Bed Convalescent Home and State Orthopedic Center.

A Physical Therapy Program in an Orthopedic School

Mae Prugger, Racine; Chief Physical Therapist, Racine Orthopedic School.

Speech Therapy and Application in Specific Cases

Inez Marvin, Milwaukee; Speech Therapist, Milwaukee Children's Hospital and Curative Workshop.

General Discussion

Items of Interest

England's *potato* crop is the biggest in many years.

Rapid cooling hardens ordinary steel, but it softens chromium-nickel *stainless steel*.

Peanut oil is being increasingly used in shortenings and oleomargarine, due to its resistance to rancidity.

Washington State's *apple orchards* trace history to apple seeds brought by a member of the Hudson Bay Company.

Government agriculturists report that *smoke* is a popular food flavor and now includes smoked cheese, turkey, game, salt and oysters.

In the isolation of the ancient world, it took the invention of *wheeled vehicles* about 2,000 miles to reach Egypt from western Asia.

British engineers report that *rubber fenders* for automobiles and trucks resist denting, are waterproof and rustless and save metal.

Besides his famous singing, the *mocking bird* broadcasts noises that have been likened to radio squeals, creaking doors, and the postman's whistle.

Kansas rates its *coal reserves* larger now than they were 20 years ago, because advances in strip-mining technique permit mining of coal beds so thin that they were formerly not considered commercially valuable.

In 20 years, scientists studying *bird habits* have banded more than 3,000,000 birds, and have obtained reports later on 200,000 of them.

An original record of *Thomas Edison's* voice has been presented to the Franklin Institute in Philadelphia by the Edison Birthday Committee.

To help solve the problem of *shelter* for migrant farm families the Farm Security Administration has established 53 camps, providing for 10,000 families.

Plastic is being carefully tested by airplane builders as a substitute for metal in flooring, cowl covers and engine baffles.

A Science-in-Sports Department and a Sports Gallery are new *museum* ventures at the Franklin Institute in Philadelphia.

Cambridge University has a collection of *potato* specimens collected in South America prior to the war, with a view to improving potato varieties.

New Radium-Like Carbon May Have Medical Uses

Modern alchemy, which turns one element into another, has now made from nitrogen a form of carbon which promises to have important uses in medicine and other sciences, announce two researchers at the University of California.

This kind, or isotope, of carbon is of mass 14, somewhat heavier than normal carbon, principally composed of the isotope of mass twelve. Unlike ordinary carbon, the new kind, C-14 gives off beta rays, one kind of radiation emitted by radium. It consists of atomic fragments called electrons. C-14 does not, however, give off gamma rays, which resemble x-rays, and are responsible for the medical effects of radium.

Dr. Samuel Ruben and M. D. Kamen, of the University of California, reveal their success in preparing appreciable quantities of C-14 with the cyclotron, or "atom-smasher," of the University. (*Physical Review*.)

For six months two five-gallon carboys of a concentrated solution of ammonium nitrate, in which no carbon is present, were exposed to a constant rain of neutrons from the atom-smasher. Some nitrogen atoms, which have the same mass as C-14, were converted into the carbon isotope. These were extracted in the form of various carbon compounds. Their radioactivity was tested by means of a Geiger counter, which detects the beta rays. The samples showed considerable activity, far more than any of the materials used originally, before the bombardment with neutrons.

It is expected that C-14 will prove important as a tracer element, in medical and botanical research, and it may be prepared commercially in large quantities for such use. Carbon is the most widespread element in living organisms. Ordinarily it is not possible to distinguish one carbon atom from another, but radioactivity forms a tag for identification. If C-14 atoms are introduced at one part of a living organism, they can be located elsewhere by their effect on a Geiger counter.

Another advantage of C-14 is that it has a long life. Continually giving off energy, radioactive elements are gradually used up. C-14 disintegrates so slowly that after 1000 years there will still be at least half of the original quantity remaining.

Dr. Ruben and Mr. Kamen point out that in some ways the long life of C-14 is unfortunate, since it requires a long time to prepare it. They point out, however, that there are methods for concentrating it from the other isotopes. In addition, they suggest, end products of a reaction in which it is used can be collected, the C-14 reconcentrated, and used over again. — *Science News Letter*.

British Students Will Complete Training Here

Sometime this spring a group of English medical students, whose studies were interrupted by German bombs that destroyed schools and hospitals, will arrive in the United States. They will be the first contingent of the group whom the Rockefeller Foundation will help to finish their studies in American and Canadian medical schools.

The plan for this type of aid to Britain was announced by Raymond B. Fosdick, president of the Rockefeller Foundation. The Foundation has appropriated \$100,000 to start the plan, which developed from a suggestion made, just before he died, by Lord Lothian, then British Ambassador to the United States.

After completion of their studies, the students will return to England. Some of the 25 leading medical schools in the United States and Canada which have readily agreed to accept these students have offered to remit their tuition. A possible extension of the plan will be considered if the first year's experience is successful.

Efforts to salvage as much as possible of the world's productive scholarship by aid to refugee scholars of continental Europe, begun by the Foundation in 1933, continues. During the year 1940, 56 refugee scholars received grants totalling \$266,350. — *Science News Letter*.

Paralysis Epidemics Linked With Sewage Disposal Method

Infantile paralysis epidemics and a recent trend in sewage disposal methods, especially in small towns, are linked in research announced by Drs. Albert E. Casey and Branch J. Aymond, Louisiana State Board of Health. (*Science*.)

Occurrence of infantile paralysis epidemics in the past few decades, they state specifically, "may have been influenced by the growing tendency of communities to liquefy their excreta without making adequate provision for the disposal of the accumulated fluids."

Infantile paralysis, they found from studying state health department reports for the 10 years 1929-1939, occurred at about the same rate in the only two large cities of Louisiana, in the rural areas and in the towns with populations between 5,000 and 49,999. The rates in these communities were about 30 cases per 100,000 population. In incorporated communities of 100 to 2,999 population, however, the rates were three times those in rural communities and larger towns.

Neither age, sex nor race factors explained the differences in infantile paralysis rates between these

different communities. The only factor which could be statistically correlated with the preponderance of infantile paralysis in the small towns was the presence of a water supply system and the absence of an adequate sewage disposal system.

The highest rates of infantile paralysis, 120 cases per 100,000 inhabitants, were found in those towns with water supply but no sewerage system, in which the average daily water supply was from 50 to 89 gallons per capita. Towns without sewerage systems in which the average daily per capita water supply was from 90 to 500 gallons had infantile paralysis rates about the same as the rural and large town communities. This suggests, Drs. Casey and Aymond state, that large amounts of fluid act as a dilution factor or as a factor increasing the rate of flow. — *Science News Letter*.

Soldiers May Carry Protection Against Germs

Soldiers — German, French, British — going into battle, may be carrying, along with vials of iodine, emergency rations, bandoliers of cartridges, life-saving pills of sulfanilamide or Pron-tosil or some related germ-defying chemical, for protection against war wound infections. Medical authorities of all belligerent forces know that the earlier in an infection these chemical remedies are given, the more effective they are. It is believed that they have supplied soldiers with prophylactic doses as battle equipment. The idea is that each soldier, if wounded, would swallow some of the protective chemical. The treatment would not be delayed even long enough to reach field dressing stations. — *Science News Letter*.

Human Body Uses Iron Over and Over Again

The human body, like industry, uses iron over and over, say scientists of the U. S. Department of Agriculture, who are studying the body's need of this essential element. Iron is used in the red blood cells. As these cells break down, about 85 per cent of the iron is recovered and returned to the bone marrow. In the whole body there is only enough iron to make an oversized shingle nail. — *Science News Letter*.

Effect of Benzedrine Due to Action on Enzyme

Benzedrine, valuable remedy for narcolepsy, owes its sleep-banishing effect to its action on a body enzyme or ferment. Narcolepsy is a condition in which the victims, like Dickens' fat boy, are seized at intervals with an uncontrollable desire for sleep.

Discovery of the action of benzedrine on a body enzyme and of the chemical structure responsible for the "awakening effect" of this and similar drugs is reported by Dr. Hermann Blaschko, of Cambridge University's physiological laboratory.

The sleep-banishing effect of benzedrine is due to the inhibitor action of this chemical and its derivatives on amine oxidase, Dr. Blaschko has found. — *Science News Letter*.

Government Listening Posts Record Foreign Propaganda

Government listening posts, where a continual watch of foreign short-wave radio broadcasts will be kept, are being established by the Federal Communications Commission and the Defense Communications Board.

To make sure that no subversive propaganda is missed, a staff of 350 technicians, translators, clerks, analysts and other experts will work in eight-hour shifts. Recordings will be made at the field stations, and the records sent to Washington for further study. Since three-quarters of these broadcasts are in foreign languages, it requires an average of seven hours' translation and study for each hour of broadcast. — *Science News Letter*.

Anti-Measles Vaccine Will Get Trials in This Epidemic

Many children in New Jersey and Philadelphia are now being vaccinated with a new and promising anti-measles vaccine, and Army medical authorities are about to consider the advisability of its use among selective service men now in training camps, where measles cases are on the increase.

The vaccine is not yet ready for general distribution and use. Dr. Geoffrey Rake, of the Squibb Institute for Medical Research at New Brunswick, N. J., with Dr. Morris F. Shaffer, developed the vaccine from measles virus grown on fertile hen's eggs.

The first vaccinations on a small group of children in Philadelphia, reported as successful last fall, were conducted under the direction of Dr. Joseph Stokes, Jr., of the University of Pennsylvania Medical School. Dr. Stokes is directing the present trials of the vaccine on a wider scale and is also director of the U. S. Army's measles commission which is just being formed and at its first meeting is expected to consider the use of the vaccine in Army training camps, according to information from Lieut.-Col. J. S. Simmons, chief, preventive medicine division, office of the Surgeon General.

The vaccination of children in New Jersey and Philadelphia orphan homes, schools and similar institutions had been planned before the present outbreak of measles started. It was delayed for six or eight weeks, however, by the influenza epidemic which struck all the institutions selected for the measles vaccine trials.

The program is now going ahead and a good start has already been made. It is hoped the vaccinations, in spite of the eight weeks set-back due to the flu, will be completed in time to protect the children during the present epidemic. Children in homes and similar institutions usually get their measles six to nine months after children in the rest of the population, because the children in the homes are relatively isolated.

The vaccine will be given to one-half the children in the selected institutions, the other one-half remaining unvaccinated. This will give scientists a control group against which to check the

protective value of the vaccine. Only children who have never had measles have been selected for both control and vaccinated groups. Permission of parents or guardians is obtained before the vaccination is done, and just about one-half of the parents or guardians have given this permission, so there has been no need to draw lots or follow any other method for division of the children into vaccinated and not-to-be vaccinated groups.

Among the questions the scientists hope to have answered by the vaccine trials are how long and how completely the vaccine protects against measles. Until such questions are answered, the vaccine will not be released for general distribution. — *Science News Letter*.

Vitamin Famine Prevalent in the United States

War may be causing famine in Europe but here in America, even without war, there is a chronic famine, Dr. Tom D. Spies, of Birmingham, Ala., declared at the meeting of the American Medical Association. The chronic famine we have here is a starving for vitamins, minerals and other precious substances found in minute amounts in foods. Large numbers of people are starved for these substances partly because they do not eat enough of the foods containing them and partly because foods as they come to the table today have lost much of their normal content of these protective substances.

About 90 per cent of the vitamin B₁, preventive of beriberi, in bread has been lost from the flour in the milling process. Water soluble vitamins are also lost to us by being washed out of the soil, so the plants today do not furnish enough of these to the animals and men that live on them, Dr. Spies said.

Death figures do not show the extent of this chronic famine in America, Dr. W. H. Sebrell of the U. S. Public Health Service declared. This, partly, is because deaths from this cause are not all recorded as pellagra or scurvy or beriberi deaths. Partly, too, it is because this famine does not kill, although it keeps people ailing and miserable and unfit for work. At least 100,000 people are probably suffering from pellagra, Dr. Sebrell estimates.

For a more complete picture of the extent of the vitamin deficiency in the country, Dr. Sebrell turned to figures on consumption of vitamin pills and similar preparations. In 1938 the people of the United States spent more than \$100,000,000 for vitamin preparations manufactured or sold through pharmaceutical channels, it is estimated. Maybe not all of this vast amount of vitamin-taking by the people was necessary to stave off vitamin famine or repair its ravages. The sum of \$26,000,000, however, was spent in 1937 on vitamins prescribed by physicians, Dr. Sebrell said.

"A figure of this magnitude," he explained, "must mean that physicians are becoming increasingly aware of the value of the preparations in treatment and, conversely, that vitamin deficiency symptoms are widely prevalent."

The figures on vitamin consumption today are probably much higher, he said, because in 1937, latest year on which figures are available, neither nicotinic acid nor riboflavin were widely used.

"Prevention and proper treatment of the nutritional diseases," he declared, "constitute one of the greatest medical problems in this country today." — *Science News Letter*.

Chemical Changes in Blood During Pneumonia Found

Significant chemical changes take place in the blood of animals suffering from pneumonia, Dr. M. L. Crossley, of the American Cyanamid Company, has found.

He and his associates, Bruno Vassel, L. G. Christopher, R. H. Kienle and G. L. Christopher, discovered changes suggesting a breakdown of the protein of blood serum during the course of the disease. When the animals got well, the blood serum became normal again.

The investigations of blood chemistry during pneumonia were undertaken in the hope of providing clues for better chemical treatment of this and other infectious or germ diseases.

"How infecting agents cause disease," Dr. Crossley explained, "what changes occur, where these changes are initiated, the nature of the resulting products and their effect on the animal are questions which must be answered before chemotherapy can be highly effective in relieving man of the many ills that now reduce his efficiency, limit his usefulness and endanger his life.

"These are difficult problems to answer. Even if microorganisms worked as termites, boring into the tissues and reducing their strength, it would still be a difficult task to examine the nature of the damage done and relate it to the cause, and man cannot be sawed up like a log nor subjected to physical and chemical tests in ordinary laboratory equipment. It is imperative to know the nature of the chemical reactions involved in infectious diseases, this knowledge is essential to the future development of chemotherapy." — *Science News Letter*.

Infra-Red Penetrates Flesh

The human body is partially transparent to infra-red rays, vibrations like light, but too long to be visible, a research trio working at the Massachusetts Institute of Technology has found. Their work was described at the meeting.

The researchers, Dr. C. Hawley Cartwright, now of the Corning Glass Works, John Daniel of the U. S. Bureau of Public Health and Alex Petruskas, measured the transmission of the rays through the cheek to the inside of the mouth. Visible light of shorter wave length, from the violet to the orange part of the spectrum, is stopped completely. The transmission begins with orange light and increases up to the longest visible red waves, where about 2 per cent is able to penetrate. These have a length of about 7,000 angstroms (about one thirty-five-thousandth of an

inch). For waves still longer, between 10,000 and 13,500 angstroms, there is more transmission, with a maximum of 3 per cent at 11,000 (one twenty-four-thousandth of an inch).

These infra-red rays are the same as heat rays. They found that by applying them from a tungsten lamp with a water filter it was possible to raise the temperature inside the mouth 3 degrees Fahrenheit without discomfort. — *Science News Letter*.

Cuff Made From Artery Used to Mend Cut Nerve

The ends of small nerves that have been cut can be reunited by holding them tightly together in a cuff made from a fragment of an artery, Dr. Paul Weiss, of the University of Chicago, reports. (*Science*.) In the case of very tiny nerves, Dr. Weiss states, neat stitching to hold the cut ends together "becomes a mechanical impossibility." Holding these little nerve ends together by ordinary sewing can never be precise enough, he says, to prevent masses of nerve fibers from "escaping into the surroundings and straying off to uncontrollable destinations." These undesirable results, he says, can be avoided by the use of the artery cuffs. — *Science News Letter*.

Microscope Cover Slips Now Made From Plastics

Cover slips, used over preparations to be examined in the microscope, are usually made of glass, but now they can be secured of transparent plastic. They are satisfactory for many purposes, though they do not resist strong acids, alcohol or acetone. (American Medical Specialties Co., 12 East 12th St., N. Y. C.) — *Science News Letter*.

New Sulfa Drug May Prevent As Well As Cure Meningitis

Hope that sulfadiazine, one of the newest of the sulfa drugs, may prove the means of preventing as well as curing meningitis appears in a war-censor-delayed report just made public.

Significant advances toward the control of diphtheria and scarlet fever as well as meningitis, were made in Halifax, N. S., this winter during epidemics which threatened to slow that prize port's steady flow of supplies to embattled Britain. The war plague fight was made by 11 American men and women comprising the Harvard Medical School expedition. Under the leadership of Dr. J. Howard Mueller, this expedition spent four weeks in the disease-ridden city studying these infections and helping local authorities to bring them under control.

The story of the expedition can be told now because the menacing epidemics have been checked; because measures have been taken which make their recurrence unlikely; and because the advances made are going to be used to strengthen America's defenses against disease.

Sulfadiazine proved the hero in the meningitis situation. This disease was never as rampant in

Halifax as was diphtheria, but it was a constant smouldering threat. The new sulfa drug was used by Dr. John H. Dingle, of the Harvard expedition, to control the situation. It appeared "to have certain advantages" over other sulfa drugs used against meningitis and was felt to be especially valuable in solving the important problem of carriers of the disease.

This is because sulfadiazine not only helps the patient to get well but apparently swiftly banishes the meningitis germs from his nose and throat, where they may lurk after he is well, constituting a hazard to other persons.

"The suggestion is obvious," Dr. Mueller reported, "that healthy carriers may be similarly cleared up."

This theory could not be verified experimentally in Halifax but it has since been confirmed by an Ottawa physician who studied troops in that area. It is an entirely new idea and one completely contrary to the experience of the last war. It may, doctors believe, be the beginning of the end of the carrier problem in meningitis.

A new and better technic for diagnosing meningitis which has certain advantages making it "particularly suitable for military use under field conditions" was developed through a new culture medium for growing meningitis germs prepared by Dr. Mueller.

A better method for dealing with the problem of protecting adults against diphtheria and more knowledge about scarlet fever, including discovery of a new strain of scarlet fever germs, are other advances made by the expedition.

The official report is being forwarded to the Surgeon General of the U. S. Public Health Service so that this nation may profit from the Halifax experience in fighting war plagues. — *Science News Letter*.

Ammonium Bicarbonate Heals Wound Infections

One of the surprising medical discoveries of the World War was that squirming maggots of the blowfly would heal stubborn wounds in human flesh. Repulsive as such a condition may be, the maggots actually kept the wounds clean and allowed them to heal. The accidental infection of the battlefield became medical practice, doctors using maggots made germ free for safety as a therapeutic aid.

Later it was found that it was a chemical that the maggots produced that did the healing. Dr.

William Robinson of the U. S. Department of Agriculture's Bureau of Entomology and Plant Quarantine in 1935 discovered that allantoin in the secretions of maggots would heal wounds rapidly.

Then he found that urea, a simpler chemical, acted similarly. Both of these chemicals were used practically.

Now a still simpler chemical, ammonium bicarbonate is found by Dr. Robinson to have the same effect. Ammonium bicarbonate is formed naturally from urea by the action of an enzyme, urease. Already tried by many physicians and surgeons, Dr. Robinson tells in a report to the *Journal of Surgery* how a 1 per cent solution of ammonium bicarbonate has proved effective when used either as a wet pack or as an irrigation of an open wound. Some of the conditions cleared up by the new treatment were: chronic osteomyelitis, diabetic and varicose ulcers, middle ear infections, stitch abscesses, infected lacerations, and other purulent wounds. — *Science News Letter*.

New Anesthesia Method Uses Pituitary Extract

Operations will be easier, for both patient and surgeon, as a result of a new way of giving anesthetics discovered by Dr. Ruth M. Latham, of Detroit. Two hours before the operation Dr. Latham injects a small amount of pitressin, extract from the posterior part of the pituitary gland. A second dose is injected just fifteen minutes before the operation. Result: much less anesthetic is needed to relax the abdominal organs, the surgeon can manipulate them more easily, and the patient awakes from the anesthetic within two or three minutes and almost never suffers from nausea, vomiting and other unpleasant after-effects from the anesthetic.

When the pituitary extract is given, ether was needed to complete the operation in only 18 per cent of the cases, as compared with 66 per cent in non-pituitary treated cases. Gas, such as the dentist uses in his office, and oxygen, sufficed to put the patient to sleep and enable the surgeon to operate in the other cases. Dr. Latham reported her results on over a hundred patients operated on for removal of gall-bladder, appendix and other types of abdominal operations to the American Medical Association in New York. — *Science News Letter*.



THE STUDENT'S LIBRARY

PHYSICAL MEDICINE. THE EMPLOYMENT OF PHYSICAL AGENTS FOR DIAGNOSIS AND THERAPY. By *Frank H. Krusen, M.D., F.A.C.P.*, Associate Professor of Physical Medicine, the Mayo Foundation, University of Minnesota; Head of Section on Physical Therapy, the Mayo Clinic; Member of the Council on Physical Therapy of the American Medical Association. Cloth. Pp. 846 with 351 illustrations. Price, \$10.00. Philadelphia: W. B. Saunders Company, 1941.

This long awaited opus by one of our most prominent proponents of physical medicine now officially enters the ranks of contributions certain to play a constructive role in the history of this branch of therapy. It has that three dimensional quality of depth, breadth and vision found only in exceptional instances where creative efforts are maintained at a hair-line balance. By depth, breadth and vision it is implied that the author has delved deep into the literature as demonstrated by the encyclopedic scope of the bibliography appended after each chapter, the objective evaluation of the myriad of facets that enter into the formation of an exact or scientific discipline, the rejection and acceptance of certain facts based on knowledge in contrast to those appealing to the imagination, and the courage to back up fundamental procedures whose validity have been established by preceding generations and are now revitalized by modern scientific methods. The book is an independent affirmation of values experienced and believed in by the author and neither burns incense nor is wholly iconoclastic. It is physical medicine as modern as the year 1941, as taught and practiced and experienced by an individual whose opportunities have been richer in background than is given the average physician.

Divided into 9 sections and 22 chapters, the text offers both student and physician a modern concept of the broad scope and usefulness of certain physical procedures in office, hospital and home practice under medical supervision. It differs from many current and valuable books in that while detailed it is not loaded with formidable expositions of a highly technical nature. Fundamental physical problems have been minimized for the benefit of subjects whose clinical value dictated greater space and broader exposition. Each of the physical agents is discussed under a definite grouping; namely, (1) introduction — definition — development — present status; (2) physics; (3) source, device, method of production; (4) physiologic effect; (5) technic of application; (6) indications; (7) contra-indications, dangers and limitations; (8) conclusions. Throughout, the author has stressed simpler and expedient measures against complicated and expensive apparatus. The text is arranged in what might be considered modernistic design, in that it begins with

a substantial history of physical therapy and continues with a review of the problems of heat and cold therapy, light, electricity, hydrotherapy, mechanotherapy and clinical aspects of physical therapy. To leave the impression that this work is not the alpha and omega or the last word that can be written on the subject would do no dishonor to the author. Its excellency is attested in so many instances that if totalled together would make such an impressive figure as to acclaim it as one of the best contributions of recent years. The publishers are also to be felicitated on their valuable cooperation, for the type, illustrations and format make an artistic framework to a valuable contribution.

THE CHEMICAL ACTION OF ULTRAVIOLET LIGHT. By *Carlton Ellis and Alfred A. Wells*. Revised and enlarged by *Francis F. Heyroth, M.D., Ph.D.*, University of Cincinnati. Cloth. Pp. 961 with 159 illustrations and numerous graphs. Price, \$12.00. New York: Reinhold Publishing Corporation, 1941.

Here is a contribution so impressive in style and content that it is difficult to avoid the superlatives that crowd for hearing in behalf of the rare excellency of this work. While the text is ostensibly addressed to a wider and more technically oriented audience than the physician, it will nevertheless be found of value to medical students as it is to advanced workers in biology and industrial fields where reference to photochemistry and fundamental information of the physical nature and technical construction of the rays and apparatus are a desideratum. Heyroth has performed a scholarly job in revising and enlarging this edition to the stature of a new and encyclopedic work without in any way dimming the credit of the original efforts of Ellis and Wells, the first authors. The text provides the most searching and detailed data on the recent advances and new interpretations of photochemical reactions in medicine and the allied sciences, to say nothing of the engineering fields. The inclusion of these new findings has necessitated the expansion of this material to a degree that has more than trebled the size of the volume. Effort has been made to include and amplify references and summaries of work subsequent to the first edition (1925) and in some instances it was even found expedient to broaden the scope beyond the limitations implied by the title by including comparisons of data related to visible light. Of especial interest to medicine is the section dealing with the biological action of ultraviolet rays. Here (part 4) the author has stressed the photochemical changes in the compounds present in living cells and the effects upon visibility and function. He has moreover introduced a detailed historical background to illus-

trate the combined efforts of physicists, organic chemists, biochemists and medical investigators in their investigation of such problems of vitamin D and other compounds by means of ultraviolet radiation. Subjects included in this volume include among others, the interpretation of absorption spectra, fluorescence, photoelectric effects and the like. Within the space of 44 chapters, divided into 4 sections and an index, the problems essential to a complete orientation of the nature, sources, mechanisms, processes and applicability of ultraviolet rays in medicine and industry have been expatiated to a scholarly degree that will meet the needs of all interested in this field of radiation. It is the most classical exposition written in any language and should be in the hands of every student and progressive physician.

THE 1940 YEAR BOOK OF RADIOLOGY. DIAGNOSIS. Edited by *Charles A. Waters, M.D.*, Associate in Roentgenology, Johns Hopkins University, etc. Associate Editor, *Whitmer B. Firor, M.D.*, Assistant in Roentgenology, Johns Hopkins University, etc. **THERAPEUTICS.** Edited by *Ira I. Kaplan, B.Sc., M.D.*, Director, Radiation Therapy Department, Bellevue Hospital, New York City, etc. Cloth. Pp. 496 with 497 illustrations. Price, \$5.00. Chicago: The Year Book Publishers, Inc., 1940.

It is conceded that no similar work on radiation therapy has captured the enthusiasm of radiologists as has this Year Book and that from its very inception. Too much praise cannot be showered on Waters and Kaplan because no group of editors occupied in like pursuits throughout the world has rendered such service as attested by the sterling quality of their labors. It already seems trite to enthuse about the quality — scholastic and artistic — of this work. One wishes that one could capture an expression that would embody all that radiology wishes to imply as a complete endorsement of this needed contribution. In the absence of such an elusive term which would define the superlative qualities of all that this volume offers to the radiologist we must content ourselves by dusting off the frequently repeated "must" of past reviews and leave its interpretation to a discriminating audience.

This year the editors have not only maintained the high water mark in their special fields of diagnoses and therapy but have contributed original articles of practical interest. Dr. Waters has brought down to date his valuable studies on irradiation of renal tumors. It is a succinct and informative summary of his many years of experience and provides added evidence by way of new case reports and long time follow-up. To the question, "Has preoperative irradiation a place in treatment of renal tumors?" he answers by statistics that five year cures have been raised to 32 per cent, six year cures to 16 per cent and seven year cures to 8 per cent. Dr. Kaplan's original article deals with even a more dramatic and practical phase of radiation—its influence on amenorrhea and sterility. It holds out such great promise to the countless individuals whose marital tragedies and sex frustrations have been the theme and objective of the creative efforts of writers and scientists throughout all ages

that one should accept the evidence at hand with all the reservation of a long awaited promise. It is impressive in its scholarly approach and convincing in its statistical conclusions. Space will not permit a more detailed evaluation of the current work except to note that a very interesting abstract is included (p. 297) which deals with the "increase of x-ray effect by local application of short wave hyperthermia." The implication is that ultrashort waves of one meter used to produce a rise of general temperature to approximately 103.1 F. in 55 minutes has a favorable sensitizing action on malignant tumors. Kaplan's comment is as objective as is permitted by limited experience and laudable conservatism.

MANUAL OF PHYSICAL DIAGNOSIS WITH SPECIAL CONSIDERATION OF THE HEART AND LUNGS. By *Maurice Levison, M.D.*, Professor of Physical Diagnosis, University of Illinois College of Medicine; Consulting Physician, Cook County Hospital; Attending Physician, Mount Sinai Hospital, Chicago, etc., and *Ellis B. Freilich, M.D.*, Associate Professor of Medicine, University of Illinois College of Medicine; Professor of Medicine, Cook County Graduate School of Medicine; Attending Physician and Chief of Tuberculosis Staff, Cook County Hospital, etc. In collaboration with *George C. Coe, M.D.*, Instructor of Medicine, University of Illinois College of Medicine; Associate Physician, Cook County Hospital, etc. Cloth. Pp. 317, with 75 illustrations. Price, \$3.00. Chicago: The Year Book Publishers, Inc., 1941.

The time when a few clinicians used to arrive at a diagnosis almost by intuition has passed long since. Today we have more or less exact methods, but their interpretation presents great difficulties and presupposes not only thorough basic training but logical reasoning. Anyone can make the motions of palpating a chest but few can correctly interpret the produced sounds. Present day medical schools are making earnest efforts to teach the students both, partly by lectures and partly by clinical exercises. The theory of physical diagnosis has been expounded in a number of good monographs, but most of these are too voluminous and perhaps too detailed to be fully absorbed by medical students whose curricula are crowded into a comparatively few years. The authors have in this instance endeavored to give the student a manual which he can study and digest within a reasonably short time. As such alone, its preparation would not be a difficult task, but to explain the whys and wherefores and to train the future generation of physicians in logical thinking and proper evaluation of diagnostic data is by no means an easy task, which they have achieved in a masterly fashion. They have stressed the diagnosis of affections of the chest and abdomen because the study of the condition of their viscera is one in depth and therefore more difficult than that of the other bodily regions, which has by no means been neglected.

Throughout the manual the student is taught the importance of being systematic, of overlooking no

means of investigation and of correlating all data for the main objective. In 20 chapters grouped as four sections, the authors show the importance of taking a complete history and following this up with a systematic examination. The special methods for examination of the respiratory and cardiovascular affections are described and explained at considerable detail. These problems are considered in the first three sections. The last section stresses the methods to be employed in examining the abdomen, with one chapter being devoted to a study of the extremities and the last one to that of the superficial and deep reflexes. It is difficult to single out any one section or chapter as being particularly praiseworthy, for all are lucid — and what is of greater importance — easily visualized. Thus, to cite one example, the student after perusal of this small guide will have no difficulty in properly interpreting the meaning of the systolic, diastolic and pulse pressures. The student who will follow the instructions will not suffer the humiliation of having overlooked a rectal carcinoma through the erroneous diagnosis of bleeding hemorrhoids, nor will he be apt to confuse functional heart symptoms with those of organic disturbances of the circulatory apparatus. These few examples show the clinical value of the book, which will be read with equal profit even by general practitioners. It is a very fine, conscientious effort in teaching manuals which no doubt will find a large number of readers especially among senior medical students. To teachers of clinical medicine the manual will be useful as a guide to terse, simplified, yet informative instruction in physical diagnosis.

THE MEDICAL PRESS AND CIRCULAR, 1839-1939. A HUNDRED YEARS IN THE LIFE OF A MEDICAL JOURNAL. By *Robert J. Rowlette, M.D., F.R.C.P.I.* Cloth. Pp. 127 with 10 plates. London: William Clowes & Sons, Limited, for the Medical Press and Circular, 1939.

Salus populi suprema lex is the motto of this medical journal, that has striven for a hundred years to make the people's health the supreme law. Its history must be of interest to everyone, especially in these times when the direct opposite is true in so many places. When the first number of the Dublin Medical Press was published, January 9, 1839, there were only two other medical journals in the British Isles, the *Lancet* founded in 1823, and the *London Medical Gazette* founded in 1827. The *Medical Circular* was launched in London in 1852. On January 6, 1866, these two journals were combined under the name of "*Dublin Medical Press and Circular*." Soon after this amalgamation Albert Alfred Tindall became the proprietor and business manager of this journal. He controlled this magazine more than 60 years. In 1868, the printing of the journal was transferred to England, ceased to be an Irish periodical, and increasingly became English in many respects.

The account is recommended to all interested in medical history. In view of the events in England today the last sentences in this volume are interesting: "What the next hundred years hold in store

for the world no one would dare to forecast, but given 'Peace on earth and good will toward men' there is no doubt but that the science of medicine will continually advance and as far as can be foreseen, medical journals will, each in its appointed sphere, continue to play their part in recording the advances made. *Salus populi suprema lex* has from the beginning been the motto of the *Medical Press and Circular*, and in point of fact health is the one thing which has real permanence in the life of every nation. To play a part in forwarding the health of the people is both an honour and a privilege, and by all those who are concerned with the production of the *Medical Press and Circular*, and indeed by all medical journals, this privilege is not one which has ever been in the past or ever will in the future be taken lightly." It can be readily seen from these thoughts that the book under discussion presents not only a good piece of the history of British medicine but of the progress of this discipline made during the course of the past century.

EDUCATION OF THE HANDICAPPED. Volume II. **PROBLEMS.** Edited by *Merle E. Frampton, Ph.D., LL.D.*, Professor of Education, Teachers' College, Columbia University, and *Hugh Grant Rowell, M.D.*, Assistant Professor of Education, Teachers' College, Columbia University. Cloth. Pp. 440. Price, \$2.40. New York: World Book Company, 1940.

The first volume dealt with the history and the education of the handicapped and the efforts made to alleviate their suffering and to educate and rehabilitate them. This volume deals with the problems of the handicapped and of those who care for them. This is a difficult task for in no area of the special work is the nomenclature or even the definition of the scope clarified. The authors call attention to the fact that since there is usually no generally accepted terminology, the result is a definite confusion such as has existed in few other educational fields. In spite of this they have done a good piece of work in making this book a helpful guide for this field of education. An excellent bibliography will aid those desiring to search further into the literature of this subject. The volume is divided into three parts. Part one surveys the field considering definitions, classifications, and the educational, medical, psychological and economic security problems. Part two discusses the problems of blind, partially-sighted, deaf, hard-of-hearing, handicapped in speech, crippled, under-vitalized cardiacs, tuberculous, or sufferers from cerebral palsy, the mentally and the socially handicapped. Part three discusses special problems solved in actual practice, such as the program for education of the handicapped in a small community used at Malverne, Long Island, and the Jersey City plan for the prevention and control of juvenile delinquency. Programs for the handicapped may be social, medical or educational in nature. In this book the principal interest rests on the educational phases. Nevertheless these three programs are closely related and this book is highly recommended

to physicians dealing with the handicapped. The authors believe that special medical service for the handicapped can be secured in most instances by a clear understanding with the local medical society.

AMATEUR RADIO. A BEGINNER'S GUIDE. By *J. Douglas Fortune*, Broadcast Engineer. Cloth. Pp. 157 with illustrations. Price, 75 cents. Chicago: Thordarson Electric Mfg. Co., 1940.

One often wonders how far is our interest in the broader problem of radio wave transmission. If it is kindred of spirit sentiment there should be more than passing curiosity of what is considered as the basis of transmission for commercial as well as biologic purposes. This small manual written by one of the most competent radio engineers presents in simple and informal exposition a fascinating discussion on the hobby of amateur radio transmission. The book is a guide for those who wish to understand the fundamentals of short wave radio as a form of pleasing recreation or diversion. Within the space of eight chapters the reader is led by easy stages through the theory and construction of simple and inexpensive apparatus, the use of codes and the understanding of the various parts that enter into the make-up and operation of an interesting avocation. It is suspected that a

large part of the medical profession is more than passively interested in this field and for that reason this work will fill a long felt need.

CHICAGO RECREATION SURVEY. Volume V: RECOMMENDATIONS AND SUMMARY OF FINDINGS. Edited by *Arthur J. Todd*, Chairman, Department of Sociology, Northwestern University. Boards. Pp. 98. Chicago: Chicago Recreation Commission, 1940.

This is the fifth and final volume of a series of publications by the Chicago Recreation Survey which presents the recommendations of the Chicago Recreation Commission arrived at on the basis of the findings of the survey published in the preceding four volumes. This is the result of a project sponsored jointly by the Chicago Recreation Commission and Northwestern University. This survey does not recommend the creation of new pressure groups, but does urge that by every possible means of instruction and communication a strong body of dynamic public opinion, unafraid and aggressive in opposition to possible apathy, laxness and corruption, constantly informed and continuously active, be developed which will be clear as to the need, positive as to objective, and united in support of law enforcement. This study is of interest to every citizen of Chicago and all social workers and civic authorities.

Low Resistance to Disease May Come From Faulty Diet

Vitamins or some other food element may prove the means of protecting children against infantile paralysis, a discovery announced by Dr. Albert B. Sabin and Dr. Carl E. Duffy, of the University of Cincinnati, suggests. (*Science*.)

Poor diet, they discovered, decreases the resistance of young rats to a disease similar to infantile paralysis in that it is caused by a virus which attacks the nervous system. The decreased resistance occurs whether the young rats are eating the poor diet during their growing period or whether their mothers were on the poor diet during the nursing period.

Lack of vitamin B₁, of riboflavin, or of vitamin E may be the dietary fault that decreases resistance to virus invasion, or there may be some other dietary fault responsible.

Animals as they grow older develop resistance to involvement of the nervous system by certain viruses, Dr. Sabin discovered in previous studies. This increased resistance with age is not due to immunity acquired through exposure of infection nor because of a maturing of the whole animal or of its entire nervous system. It is the result of changes in certain tissues or structures which the viruses must pass before they can give rise to paralysis or encephalitis ("sleeping sickness").

These tissue changes, the latest studies show, are influenced by the diet of either the growing animal or its mother during the nursing period.

While inadequate nutrition could prevent or retard appearance of resistance to virus invasion of nervous tissue in young animals, it has not been possible to break down this resistance by poor diet in full-grown animals once they have acquired the resistance to the virus. — *Science News Letter*.



INTERNATIONAL ABSTRACTS

Physical Therapy in the Field of Otolaryngology. Highlights of Some Specifically Adapted Conditions. Lewis J. Silvers.

Med. Record 152:427 (Dec. 18) 1940.

The most common nasal involvement is probably epistaxis. A mild dose of electrocoagulation is usually sufficient to eradicate the friable vessels. Desiccation with the Oudin current is generally indicated when the vessels are very fine and extremely superficial. Nasal synechiae are best severed by the cutting current.

Nasal allergy and the resultant complications of chronic sinusitis and polyposis require treatment directed *en masse* for their proper eradication. Ionization under positive polarity will palliate the hypersensitive mucosa. Coagulation to each of the attachments of the nasal polyps will cut off their supply of nourishment.

Erysipelas of the nasal area is quickly controlled by interior doses of ultraviolet. Titus concluded that the effect of irradiation was a specific antitoxic effect and not due to a sterilization of the focus. Approximately twenty to twenty-five times the erythema dose of ultraviolet is applied to the lesion and surrounding healthy epidermis. Rarely are more than two or three treatments required for total cure of the most severe form of erysipelas.

Atrophic rhinitis, the *bete noir* of the otolaryngologist, is best treated by iontophoresis. A one per cent solution of zinc sulphate is used to saturate the nasal tampons which are connected to the negative pole of the galvanic current. A dose of three milliamperes for a period of fifteen minutes every five to seven days will usually bring salutary results in from six to ten treatments.

Acute infectious sinusitis is best treated by tamponage with vasoconstrictor drugs while exposed to infra-red and ultraviolet wave diathermy. Chronic atrophic sinusitis, as its precursor chronic atrophic rhinitis, requires stimulative and supportive treatment. Reversed ionization (negative pole), intranasal diathermy and topical application of ultraviolet rays are here indicated. General supportive therapy includes the judicious use of ultraviolet therapy generally, and hormonal and vitamin therapy as adjuvants.

Among the indications for electrosurgical tonsillectomy are those inoperable cases which show marked lymphadenoid enlargement with cervical nodes enlarged and a history of tuberculosis either active or inactive. In the active cases extreme patience and care must be observed and the amount of coagulation reduced to a minimum at each weekly sitting.

Pain and hemorrhage are entirely avoidable in electrosurgical tonsillectomy. Pain is avoided by

the use of topical anesthesia and the careful application of the biterminal current to the tonsil only. Tonsillar tissue registers no pain, and hemorrhage is absent when speed is not sacrificed for safety. Never penetrate deeper into the tonsil than one millimeter.

Periarthritis of the Shoulder. Walter M. Solomon.

Physiotherapy Rev. 20:323 (Nov.-Dec.) 1940.

In the acute cases with much pain and muscle spasm it often is time-saving to put the patient to bed, with the arm fixed in moderate abduction of about 90 degrees and external rotation, which position may be secured by gentle traction from above and below the elbow.

Too frequently a physician will attempt to carry a patient through the acute phase merely by prescribing pain-relieving drugs, vainly hoping that when this phase is over, normal function will return. It is then that such patients are referred to the physical therapy department which fortunately still can provide much help.

The treatments at this stage consist of heat, massage and exercise. Heat is best applied as short wave diathermy either with the anterior-posterior technic of application of the pads or the pancake method with the coil. Massage certainly should be utilized in this stage. Exercises both active and passive are necessary if the so-called "frozen shoulder" is to be restored to normal function. Since abduction and rotation movements are limited, they are emphasized, particularly external rotation.

If after a trial of a few weeks with diathermy, massage and active and passive motion, there is little or no improvement as checked with a goniometer, the patient is a possible candidate for manipulation. It is well to remember that manipulation must not be attempted in the early cases, and one should not attempt forceful passive motion even at this stage. Forceful treatment tears the already inflamed tissues and increases the serofibrinous exudation.

The manipulation usually is carried out under gas anesthesia. Several authors stress that only one motion should be attempted at a time. The majority favor rotation of the shoulder joint both internal and external, for by these two maneuvers most of the adhesions are broken up.

As soon as possible, physical therapy is resumed to prevent the formation of new adhesions. Heat and massage are applied again, and exercises both active and passive are attempted a number of times daily. Following the treatment the arm always is tied back in complete abduction and external rotation.

Antirachitic Curative Power of Irradiated Milk.
K. Scheer.

Kinderärztl. Praxis 11:113 (April) 1940.

Scheer states that the antirachitic effects of irradiated milk have been partly forgotten and that confused ideas exist regarding irradiated milk. Many are of the opinion that irradiated milk has a prophylactic but no therapeutic action. The author demonstrates the great antirachitic power of irradiated milk on the basis of new investigations. He reviews twelve cases of rickets occurring in different seasons of the year. Roentgenograms of five cases show that even severe forms of rickets are cured within a few weeks. The cure is not as rapid as when large doses of irradiated ergosterol are given. Feeding with irradiated milk has the therapeutic effect of the daily administration of about 6,000 international units. The children received the quantity of milk that corresponded to their age and their state of nutrition. They were given no other antirachitic treatment. That irradiated milk exerts no harmful effect has been proved by observations on 500 children. This milk is unchanged in odor and taste. Although the therapeutic action of irradiated milk has been demonstrated, its chief value is in the prophylaxis of rickets, because it can be provided for every child and the expense involved is small. — [Abstr. J. A. M. A. 115:19 (Nov. 9) 1940.]

Malaria and Artificial Fever in the Treatment of Paresis. Paul A. O'Leary; Walter L. Bruetsch; Franklin G. Ebaugh; Walter H. Simpson; Harry C. Solomon; Stafford L. Warren, Co-operating Clinics, and R. A. Vonderlehr, Lida J. Usilton, and I. V. Sollins, for the U. S. Public Health Service.

J. A. M. A. 115:677 (Aug. 31) 1940.

This study evaluates the clinical and serologic results obtained in paresis with artificial fever as compared with malaria therapy. There were 1,100 patients treated with malaria and 320 treated with artificial fever. O'Leary found that under either method, the earlier in its course the paresis was treated the more favorable were the results of therapy. The chances of clinical remission in patients with mild paresis were approximately one out of two; intermediate paresis, one out of four, and severe paresis from one to ten out of 100. Clinical responses to either type of fever therapy were similar in patients with mild or intermediate paresis on beginning of treatment. However, this similarity disappeared when treatment was administered to patients with severe paresis. In fact, the remission rates for patients with severe paresis treated and observed for the same length of time was one out of 100 with malaria, as compared with ten out of 100 with artificial fever. Treatment deaths were defined as due to treatment regardless of cause, provided death occurred within three months of the fever therapy. Under this definition the crude death rate was higher with malaria (13 per cent) than with artificial fever (8 per cent). The more severe the

paresis on beginning treatment with either type of therapy, the higher was the frequency of death. Within each degree of paretic involvement the crude death rate was higher under malaria than under artificial fever. These differences in death rates by degree of involvement under the two methods of fever therapy were not statistically significant but as a series they all point in the same direction.

Effect of Temperature on Growth of Frog Carcinoma. Balduin Lucke, and H. Schlumberger.

J. Exper. Med. 72:321 (Sept.) 1940.

Just as in normal tissues, it has been found that growth and development of a malignant neoplasm are influenced by temperature both quantitatively and qualitatively. The most striking effect was the acceleration in the rate of growth of the tumor at higher temperature, and retardation at lower. The ultimate size attained within periods averaging three months was regularly much greater at higher temperature. Also, the character of growth was quite different. At high temperature, there was more efficient vascularization, and the tumors formed long, branching, tubular outgrowths and cysts; at low temperature the outgrowths were short and stubby and cysts were rare.

These differences were accentuated by repeatedly passing the tumor from one generation to another. In particular, in such serial passages, there was a remarkable tendency for the tumor to develop greatly dilated tubules and large cysts, which later, however, became solid as the result of ingrowth from the wall. Experiments demonstrate that carcinoma in the frog can exist over a wide range of temperature. Even a temperature as low as 4. C. as in hibernation, produces no injury to the tumor. This result is consistent with the common occurrence of large, healthy, spontaneous tumors in frogs which have recently hibernated in their natural state.

Microscopic Structure of Striated Muscle in Heat Rigor. Eben J. Carey.

Arch. Path. 30:881 (Oct.) 1940.

The effect of heat rigor on striated muscle is summarized by Carey as follows:

Heat rigor of short duration is microscopically characterized by nodes and internodes, the component parts of strong contraction compression waves, in smooth intestinal, transitional gizzard and striated muscle in isometric contracture. The pressure nodes of the striated fiber contraction waves have deep differential chemical staining, wide diameter, condensed cytoplasm and rounded, compressed nuclei, multiplication of fine striae and an increase of anisotropy and mineral ash content. The tension internodes stain relatively less deeply and have narrow diameters, rarefied fibrillated cytoplasm, greatly elongated nuclei, coarse striae and a decrease of anisotropy and mineral content. The multiplication of nodal striae is best observed in nodes placed obliquely to the long axis of the muscle fiber and in partial

contraction nodes of the muscle fiber. In the obliquely placed and partial contraction nodes the cleavage of the coarse, relatively inactive internodal striation into two, three or four fine active nodal striations is microscopically evident. Substantial histologic evidence appears to be presented that warrants the conclusion that the contraction node of heat rigor is not the result of a mere mechanical approximation of previously noncontracted striations but represents active multiplication of new fine and closely placed striae continuous with the coarse, inactive ones. There are variable degrees of muscle twitches, contraction and contracture with and without increase in the number of striations. The homogeneous nodes of intense heat rigor resemble those of Zenker's degeneration accompanying the fever of typhoid and pneumonia. Altered chemical changes in the muscle fiber appear to underlie and to be associated with the structural variations identified in heat rigor or contracture. The strong contraction compression waves of nodes and internodes associated with the chemical changes are oriented and aligned into dark and light bands of compression and rarefaction by the microcapillary influence of the striated muscle fibers of fibrils.

Possible Significance of Inhibitory Effect of Fever on Anaphylactic Phenomena. Paul De Kruif, and Walter M. Simpson.

J. Lab. & Clin. Med. 26:125 (Oct.) 1940.

Lack of any rational explanation for the favorable influence of fever upon several unrelated disease states, stimulated search for some basic underlying mechanism for the therapeutic action of fever. The common denominator in the favorable effect of fever in such clinically different conditions as sensitiveness to arsenic, chorea, other manifestations of the rheumatic state, asthma and other allergic phenomena, appears to be the inhibition of anaphylaxis. It is suggested that the phenomenon of inhibition of classic anaphylaxis in the guinea pig by body temperatures at levels safely employed in fever therapy of human beings may provide a crucial experimental explanation of these hitherto empirical therapeutic effects.

Control of Infection Begins in the Cradle. Carl A. Erikson, and Louis W. Sauer.

Mod. Hosp. 55:54 (Oct.) 1940.

While the institution known as "The Cradle" is not a hospital, its technics already developed and tested are of far-reaching significance for hospitals and institutions that care for infants. After a prolonged epidemic of enteritis in 1927-'28, resulting in 27 deaths, the Cradle was about to close when Dr. Gladys Dick proposed an individual, aseptic isolation technic. This was supplemented by improvised partial cubicles, installed in what had been bedrooms of two ordinary Evanston houses. In the succeeding twelve years, more than 2700 babies were cared for with a total of only 24 deaths.

In this unique experiment three distinct attempts are made to control air-borne cross-infections. All have the common factor of complete and controllable air conditioning. One has nothing more; the second has two variations in the use of bactericidal ultraviolet light barriers, and the third has two variations of physical barriers. As the babies in these cubicles seldom leave them from admission to discharge, usually eight weeks or more, the results in future years may provide significant answers to many of the problems that arise in preventing air-borne infection.

Effect of High Temperature on Body Functions—A Symposium—The Regulation of Body Temperature. Henry Laurens.

New Orleans M. & S. J. 93:283 (Dec.) 1940.

The author refers to the work of Dell, who in his book on Life, Heat and Altitude points out that successful adaptation to high temperatures consists in the following: (1) An ability of the sweat glands to "learn" to secrete enough water to cool the body; (2) an ability to secrete this water with minimal amount of chloride, so as to conserve extracellular water and prevent depletion of sodium chloride; (3) an ability of the circulation to supply enough blood to the periphery to be cooled; and (4) the successful integration of these abilities to permit maximum loss of heat with minimum rise in body temperature.

Neurocirculatory Asthenia. C. L. Hartsock.

Cleveland Clin. Quart. 8:42 (Jan.) 1941.

The strong emotions engendered by war are certain to revive that condition which, common enough during peace times, was unusually prevalent during the following the last great war — neurocirculatory asthenia.

To those familiar with the diagnosis and management of functional problems, the recognition of neurocirculatory asthenia is simple in most cases, made by a quick glance at the facies, a handshake, and a few simple questions to analyze the personality of the patient. The chief symptoms are nervousness, fatigue, heart consciousness and palpitation, and nearly always some form of gastrointestinal disturbance. Other suggestive symptoms are tremor, peculiar feelings in the head, dizziness of the vasovagal type, photophobia and aching eyes, globus hystericus, sighing respirations, syncopal attacks, all varieties of gastrointestinal disturbances, all varieties of peculiar somatic sensations, excessive perspiration, frequency of urination, disturbed fears concerning sex and peculiar sensations about the genitalia, and many other complaints.

No specific medical treatment has any effect upon this condition. Treatment of the annoying symptoms helps to halt the vicious cycle. Psychotherapy through instillation of confidence, while difficult to evaluate, certainly appears to be most important. A long talk with the patient is necessary to impress him with the fact that all his symptoms are due to an emotional upset

of the sympathetic nervous system. This is relatively easy because the patient immediately realizes that all of his symptoms are like stage fright.

The enormous requirements for physical rest must be emphasized. Most of these patients do unusually well on ten hours of bed rest, but seldom get along well on less.

A very simple and effective method of treatment in relieving the annoying vasomotor symptoms is to perform calisthenic exercises for ten minutes, endeavoring to bring out a good sweat, using adequate clothing during the exercise if sweating is difficult. Following this, the patient should take a cold shower immediately or plunge into a tub of cold water previously drawn. Long and hot baths should not be taken as they cause further peripheral vascular dilatation.

After the cold plunge and the skin dried it is essential to obtain complete relaxation for thirty minutes. This regimen to be carried out daily.

Effects of Hyperthermia and Hypothermia on Cervical Lymph Flow. Jane D. McCarrell.

Am. J. Physiol. 130:34 (July 1) 1940.

The experiments on the effects of local heat and cold upon cervical lymph flow (McCarrell, 1939-1940) suggested a further study of lymph formation and movement as a result of general heating and cooling of the body. The recent therapeutic use of hyperthermia and hypothermia has stimulated interest in the physiological changes, particularly those involving the circulatory system, brought about by abnormally high or low body temperatures. That alternations in lymph flow probably occur as a result of these circulatory changes has often been inferred, but actual experimental proof is meager.

Nine dogs and two cats, anesthetized and curarized, were subject to a high environmental temperature (40 to 45 C.) at an average relative humidity of 11 per cent. The hyperthermia thus produced caused marked circulatory changes culminating in circulatory collapse and death at 45.3 to 45.7 C. Cervical lymph flow increased and protein percentage decreased at two critical body temperature levels. The first rise, which amounted to 1.4 to 4.5 times the control values and which occurred at a body temperature of 38.3 to 41.1 C., was due to an increase in the rate of capillary filtration caused by peripheral hyperemia. The second increase in cervical lymph flow, amount-

ing to 3 to 18 times the normal, appeared at a temperature of 41.9 to 43.5 C., was coincident with the beginning of circulatory collapse, and was caused by a tremendous increase in capillary filtration resulting from a high venous pressure and from capillary stasis and anoxemia leading to injury to the capillary endothelium.

Cervical lymph flow in three dogs subjected to low environmental temperatures (10 C. minimum) failed to be significantly altered when the body temperature was reduced to a minimum value of 25.6 C. With the exception of a decreased heat rate, circulatory changes were not pronounced at this degree of hypothermia. Thoracic duct flow tended to be so variable that no conclusions can be drawn as to the possible influence of changes in body temperature on its production.

Cryotherapy and Its Relation to Hibernation. W. Laurence Whittemore; James R. Lisa, and Paul K. Sauer.

New York State J. Med. 40:1563 (Nov. 1) 1940.

One hundred and forty-two years ago Dr. James Currie, F.R.S., Edinburgh, and physician to the Liverpool Hospital, reported that he had lowered the temperature of Richard Sutton to 83 F., while keeping him in a brine bath at 40 F. over a period of forty-five minutes. But aside from Dr. Currie's experiments on healthy individuals a careful perusal of the literature fails to reveal any such cooling in human beings until Temple Fay and Lawrence Smith announced their findings in a very careful and complete report on "Temperature Factors in Cancer and Embryonal Cell Growth."

As our understanding of cryotherapy increases it may happen that there will be a change in our technic, enabling us to approximate more closely a state of true hibernation. That there are other fields in addition to the treatment of malignant disease is also suggested. The possibility of its use in cardiac disease is suggested from the work of Marshall Hall. Its applicability to various types of mental disease is suggested by the experiments of James Currie. Cases of chemical poisonings, polycythemia vera, snake venoms, and infections seem a rich field for investigation, while the results obtained and reported so far in human cryotherapy in cancer warrant further observation.

